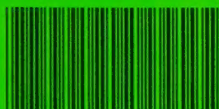


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SERVICE MANUAL

DIGITAL
AC METER
Type 2504

MP MASTER



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YOKOGAWA ELECTRIC WORKS, LTD.



SERVICE MANUAL

DIGITAL AC METER Type 2504

1976, 05, 25 1st Edition

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1. FUNCTIONS, COMPOSITION AND OPERATING PRINCIPLES

1.1 Introduction

This chapter concerns basic functions, composition and operating principles of the overall circuitry and component assemblies of the Type 2504 Digital AC Meter.

It is recommended to familiarize yourself with handling of the instrument by reading through its instruction manual before proceeding to servicing.

1.2 Functions and Composition

The Type 2504 has measurement functions similar to those in the Type 2503 Digital AC Power Meter. It consists of a mainframe (ac meter assembly) having display and measurement functions, and a plugin input module.

Combination of function cards in the mainframe determines which measurement functions are selected and whether or not a ranging function is equipped. Measurement range is determined by which input module is taken. Such different aspects are distinguished by a subtype number consisting of two figures such as placed in the squares in Type 2504-□□.

Furthermore, BCD output and remote control are arbitrarily provided by adding the BCD OUTPUT CARD Ass'y: Type 2514-90. All these constitute forty-eight different combinations as illustrated in Fig. 1-1, thereby satisfying the ever-diversifying needs of the user.

This service manual concerns mainly the ac meter assembly (Type 2504-□□) of the Digital AC Meter. For the input module, refer to a separate service manual for the Type 2514 INPUT MODULE.

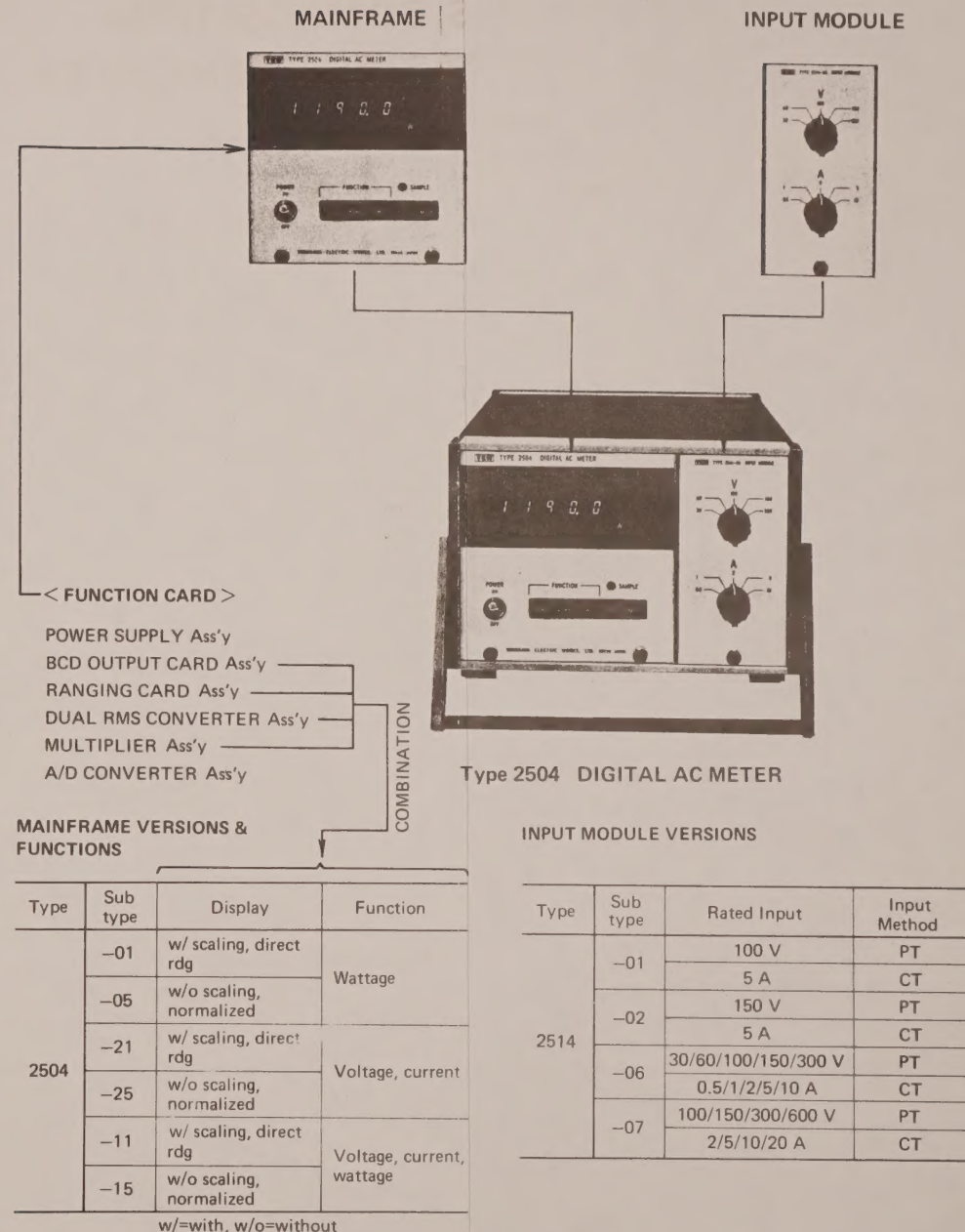


Fig. 1-1 Composition

1.3 Overall Operation

Discussion will be made referring to the block diagram for the Type 2504-□□ in Fig. 1-2.

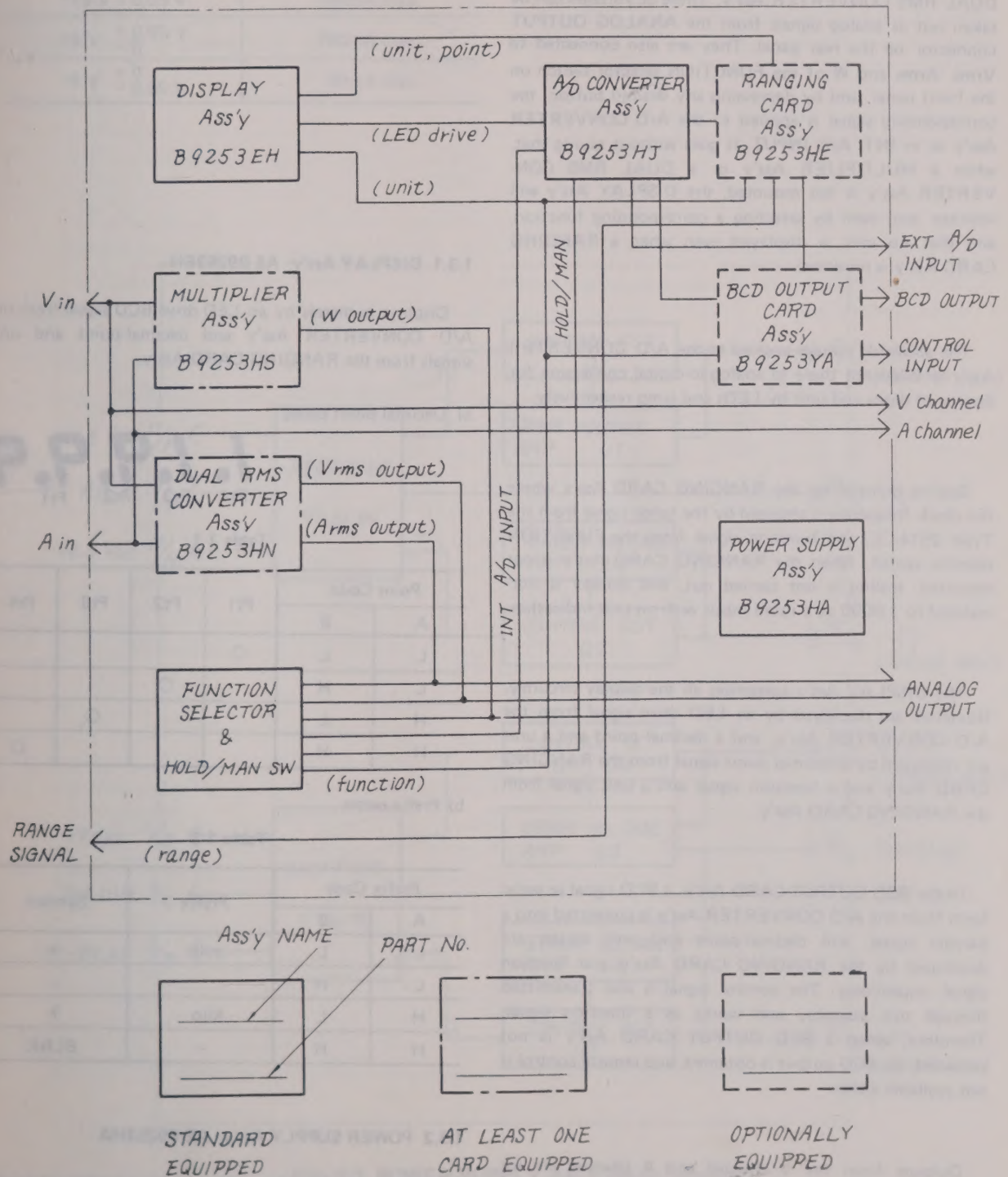


Fig. 1-2 Block Diagram

The Type 2514-□□ gives signals which are 1 V rms at rated input to the Vin and Ain terminals. These signals are converted into a dc voltage (rated +5 V) proportional to the effective power by the MULTIPLIER Ass'y, and another dc voltage (rated +5 V) proportional to the rms value by the DUAL RMS CONVERTER Ass'y. These dc voltages can be taken out as analog signals from the ANALOG OUTPUT connector on the rear panel. They are also connected to **Vrms**, **Arms** and **W** of the FUNCTION selector switch on the front panel, and by depressing any desired button, the corresponding signal is applied to the A/D CONVERTER Ass'y as in INT. A/D INPUT. It goes without saying that, when a MULTIPLIER Ass'y or a DUAL RMS CONVERTER Ass'y is not mounted, the DISPLAY Ass'y will indicate zero even by selecting a corresponding function, and that no unit is displayed even when a RANGING CARD Ass'y is mounted.

The above dc voltage applied to the A/D CONVERTER Ass'y is subjected there to analog-to-digital conversion for display of digits and unit by LEDs and lamp respectively.

Scaling is made by the RANGING CARD Ass'y where the clock frequency is changed by the range signal from the Type 2514-□□ and function signal from the FUNCTION selector switch. When the RANGING CARD Ass'y is not mounted, scaling is not carried out, and display is normalized to 1.0000 at a rated input with no unit indication.

The DISPLAY Ass'y comprises all the display circuitry. Numerals are displayed by an LED drive signal from the A/D CONVERTER Ass'y, and a decimal point and a unit are displayed by a decimal point signal from the RANGING CARD Ass'y and a function signal and a unit signal from the RANGING CARD Ass'y.

In the BCD OUTPUT CARD Ass'y, a BCD signal in serial form from the A/D CONVERTER Ass'y is converted into a parallel signal, and decimal-point and unit signals are developed by the RANGING CARD Ass'y and function signal respectively. The control signal is also transmitted through this assembly and works as a function signal. Therefore, when a BCD OUTPUT CARD Ass'y is not provided, no BCD output is obtained, and remote control is not available either.

Outputs from the V channel and A channel are for observation of an input voltage or current on an oscilloscope, and have a level of approximately 1 V rms at rated inputs.

Composition and operating principles of each assembly are as stated below.

1.3.1 DISPLAY Ass'y: AS B9253EH

Displays numerals by an LED drive BCD signal from the A/D CONVERTER Ass'y and decimal-point and unit signals from the RANGING CARD Ass'y.

a) Decimal-point codes

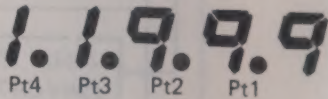


Table 1-1

Point Code		Pt1	Pt2	Pt3	Pt4
A	B				
L	L	○			
L	H		○		
H	L			○	
H	H				○

b) Prefix codes

Table 1-2

Prefix Code		Prefix	Symbol
A	B		
L	L	milli	m
L	H		—
H	L	kilo	k
H	H	—	BLNK

1.3.2 POWER SUPPLY Ass'y: AS B9253HA

Incorporates four dc stabilized power supplies of a series stabilization method as illustrated in Fig. 1-3. Its output voltages and currents are as given in Table 1-3.

Table 1-3

Output Voltage	Output Current
+15 V ± 0.05 V	200mA max.
-15 V ± 0.05 V	180mA max.
+5 V ± 0.05 V -0	750mA max.
-5 V ± 0 -0.05 V	30mA max.

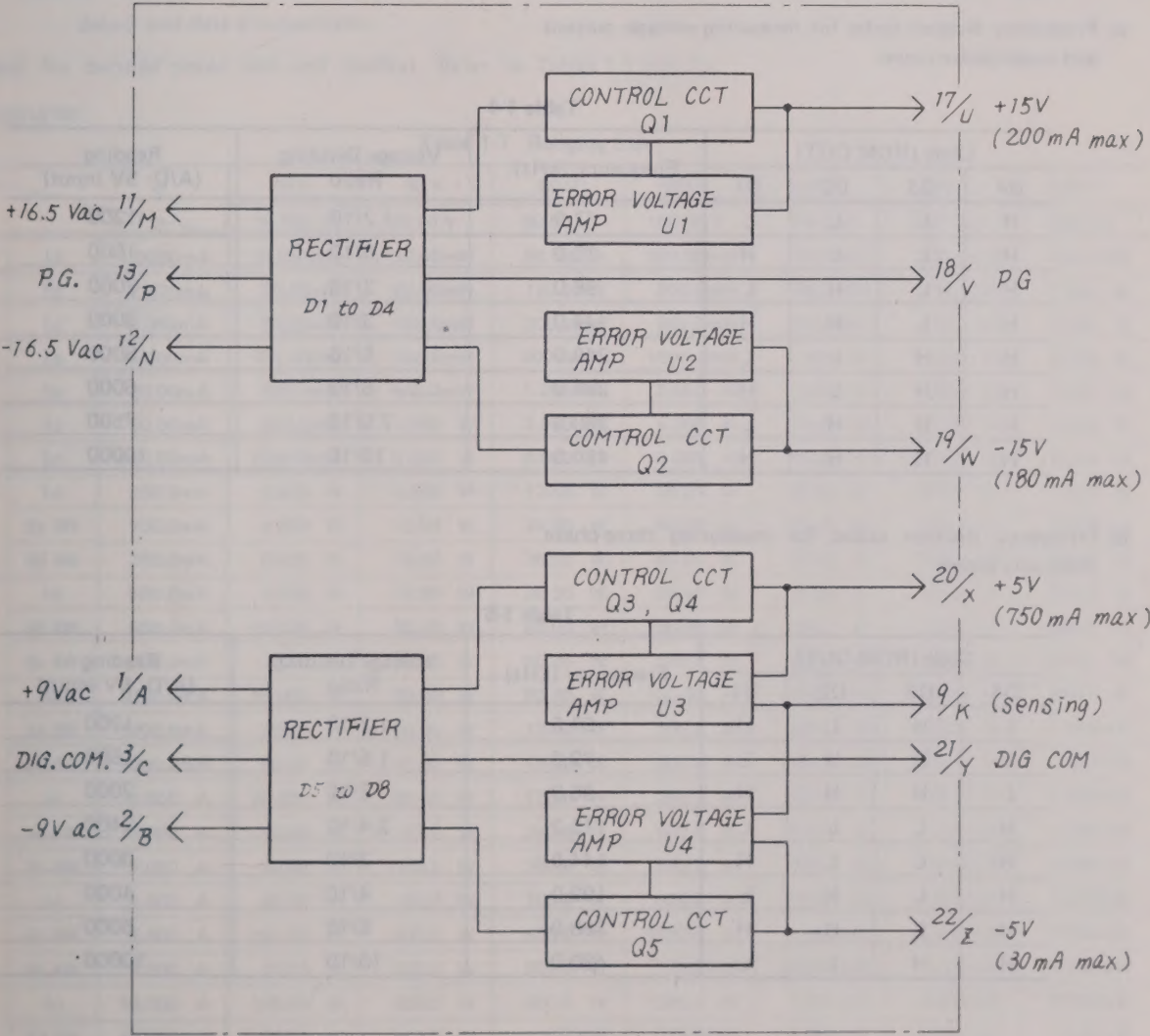


Fig. 1-3 POWER SUPPLY Ass'y Block Diagram

1.3.3 RANGING CARD Ass'y: AS B9253HE

Carries out scaling digitally so that each input quantity will be directly read in accordance with a corresponding function such as V, A, W (1 φ), W (3 φ , 3 W), W (3 φ , 4 W), etc. and combination of voltage and current measurement ranges. Generates at the same time decimal-point and unit (prefix) signals to be sent out to the DISPLAY Ass'y and BCD OUTPUT CARD Ass'y.

Scaling action is made by changing the counted frequency of the A/D CONVERTER Ass'y.

To fulfill this object, a silicon-gate MOS ROM (mark: 2504) is employed in this assembly. By applying data of voltage, current range and function, counted-frequency selection code (4 bits) and decimal-point and unit (prefix) codes are taken out as outputs.

Appropriate frequency, decimal-point and unit signals are transmitted from this assembly to others through the said codes.

a) Frequency division codes for measuring voltage, current and single-phase power

Table 1-4

Code (ROM OUT)				Frequency (kHz)	Voltage Dividing Ratio	Reading (A/D: 5V input)
D4	D3	D2	D1			
H	L	L	L	57.6	1.2/10	1200
H	L	L	H	72.0	1.5/10	1500
H	L	H	L	96.0	2/10	2000
H	L	H	H	144.0	3/10	3000
H	H	L	L	240.0	5/10	5000
H	H	L	H	288.0	6/10	6000
H	H	H	L	360.0	7.5/10	7500
H	H	H	H	480.0	10/10	10000

b) Frequency division codes for measuring three-phase three-wire power

Table 1-5

Code (ROM OUT)				Frequency (kHz)	Voltage Dividing Ratio	Reading (A/D: 5V input)
D4	D3	D2	D1			
L	H	L	H	57.6	1.2/10	1200
L	H	H	L	72.0	1.5/10	1500
L	H	H	H	96.0	2/10	2000
H	L	L	L	115.2	2.4/10	2400
H	L	L	H	144.0	3/10	3000
H	L	H	L	192.0	4/10	4000
H	L	H	H	288.0	6/10	6000
H	H	L	L	480.0	10/10	10000

c) Frequency division codes for measuring three-phase
four-wire power

Table 1-6

Code (ROM OUT)				Frequency (kHz)	Voltage Dividing Ratio	Reading (A/D: 5V input)
D4	D3	D2	D1			
L	H	L	L	72.0	1.5/10	1500
L	H	L	H	86.4	1.8/10	1800
L	H	H	L	108.0	2.25/10	2250
L	H	H	H	144.0	3/10	3000
H	L	L	L	172.8	3.6/10	3600
H	L	L	H	216.0	4.5/10	4500
H	L	H	L	288.0	6/10	6000
H	L	H	H	432.0	9/10	9000

Note: In a), b) and c) above, codes D1, D2, D3 and D4 correspond to ROM outputs data-1, data-2, data-3 and data-4 respectively.

d) Codes for decimal point and unit (prefix). Refer to Tables 1-1 and 1-2.

e) Ranging list

Table 1-7 Ranging List

V			10 V	30 V	60 V	100 V	150 V	300 V	600 V
			10.000 V	30.00 V	60.00 V	100.00 V	150.0 V	300.0 V	600.0 V
A	1mA	1ϕ 1.000mA	10.000mW	30.00mW	60.00mW	100.00mW	150.0mW	300.0mW	600.0mW
	2mA	1ϕ 2.000mA	20.00mW	60.00mW	120.0mW	200.0mW	300.0mW	600.0mW	1.200 W
	5mA	1ϕ 5.000mA	50.00mW	150.0mW	300.0mW	500.0mW	750.0mW	1.500 W	3.000 W
	10mA	1ϕ 10.000mA	100.00mW	300.0mW	600.0mW	1000.0mW	1.500 W	3.000 W	6.000 W
	20mA	1ϕ 20.00mA	200.0mW	600.0mW	1.200 W	2.000 W	3.000 W	6.000 W	12.00 W
	50mA	1ϕ 50.00mA	500.0mW	1.500 W	3.000 W	5.000 W	7.500 W	15.00 W	30.00 W
	0.1A	1ϕ 100.00mA	1000.0mW	3.000 W	6.000 W	10.000 W	15.00 W	30.00 W	60.00 W
0.2A	1ϕ	200.0mA	2.000 W	6.000 W	12.00 W	20.00 W	30.00 W	60.00 W	120.0 W
	3ϕ 3W	200.0mA	4.000 W	12.00 W	24.00 W	40.00 W	60.00 W	120.0 W	240.0 W
	3ϕ 4W	200.0mA	6.000 W	18.00 W	36.00 W	60.00 W	90.00 W	180.0 W	360.0 W
0.5A	1ϕ	500.0mA	5.000 W	15.00 W	30.00 W	50.00 W	75.00 W	150.0 W	300.0 W
	3ϕ 3W	500.0mA	10.000 W	30.00 W	60.00 W	100.00 W	150.0 W	300.0 W	600.0 W
	3ϕ 4W	500.0mA	15.00 W	45.00 W	90.00 W	150.0 W	225.0 W	450.0 W	900.0 W
1A	1ϕ	1000.0mA	10.000 W	30.00 W	60.00 W	100.00 W	150.0 W	300.0 W	600.0 W
	3ϕ 3W	1000.0mA	20.00 W	60.00 W	120.0 W	200.0 W	300.0 W	600.0 W	1.200 kW
	3ϕ 4W	1000.0mA	30.00 W	90.00 W	180.0 W	300.0 W	450.0 W	900.0 W	1.800 kW
2A	1ϕ	2.000 A	20.000 W	60.00 W	120.0 W	200.0 W	300.0 W	600.0 W	1.200 kW
	3ϕ 3W	2.000 A	40.00 W	120.0 W	240.0 W	400.0 W	600.0 W	1.200 kW	2.400 kW
	3ϕ 4W	2.000 A	60.00 W	180.0 W	360.0 W	600.0 W	900.0 W	1.800 kW	3.600 kW
5A	1ϕ	5.000 A	50.00 W	150.0 W	300.0 W	500.0 W	750.0 W	1.500 kW	3.000 kW
	3ϕ 3W	5.000 A	100.00 W	300.0 W	600.0 W	1000.0 W	1.500 kW	3.000 kW	6.000 kW
	3ϕ 4W	5.000 A	150.0 W	450.0 W	900.0 W	1.500 kW	2.250 kW	4.500 kW	9.000 kW
10A	1ϕ	10.000 A	100.00 W	300.0 W	600.0 W	1000.0 W	1.500 kW	3.000 kW	6.000 kW
	3ϕ 3W	10.000 A	200.0 W	600.0 W	1.200 kW	2.000 kW	3.000 kW	6.000 kW	12.00 kW
	3ϕ 4W	10.000 A	300.0 W	900.0 W	1.800 kW	3.000 kW	4.500 kW	9.000 kW	18.00 kW
20A	1ϕ	20.00 A	200.0 W	600.0 W	1.200 kW	2.000 kW	3.000 kW	6.000 kW	12.00 kW
	3ϕ 3W	20.00 A	400.0 W	1.200 kW	2.400 kW	4.000 kW	6.000 kW	12.00 kW	24.00 kW
	3ϕ 4W	20.00 A	600.0 W	1.800 kW	3.600 kW	6.000 kW	9.000 kW	18.00 kW	36.00 kW

1.3.3.1 Basic circuit and operation

Figs. 1-4 and 1-5 show the basic circuit and time chart.

When the overscale signal level of the A/D CONVERTER is H in Fig. 1-4, the main clock functions at 480 kHz, and when the level is L, the main clock functions at f kHz.

Fig 1-5 is a time chart illustrating the action of the A/D CONVERTER. By changing the frequency to f kHz after the maximum count (11999), scaling of f -kHz/480 kHz is made.

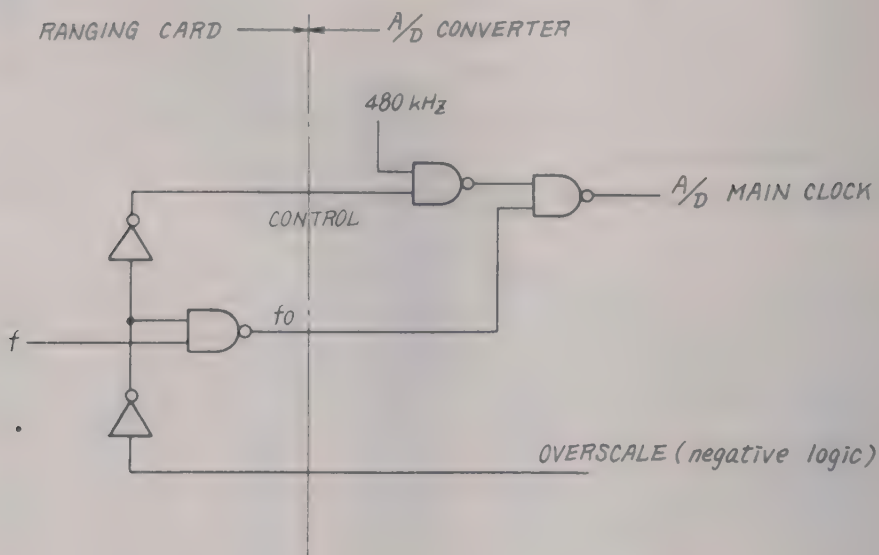


Fig. 1-4 Basic Circuit Diagram

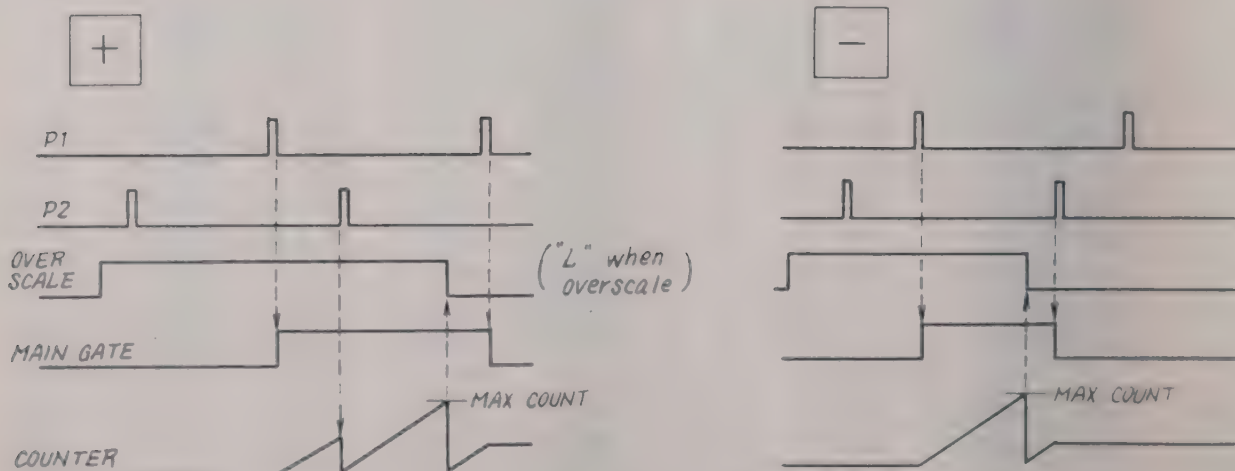


Fig. 1-5 Time Chart

1.3.3.2 Basic circuit for scaling

– Relationship between measurement of single-phase power, voltage and current, and measurement of three-phase three-wire and four-wire systems –

Rated input voltage of the A/D CONVERTER is normalized to 5 V dc for measurement of any functions.

Therefore, unlike a single-phase power, voltage or current, measurement of three-phase three-wire or four-wire system will give the following values taking 100-V and 1-A ranges for example.

- Single phase: 100 W
- Three-phase three-wire: $200\text{ W} \dots W_1 + W_2$
- Three-phase four-wire: $300\text{ W} \dots W_1 + W_2 + W_3$

It shows that scaling two or three times that of the single phase is necessary.

When three-phase three-wire and four-wire systems are also taken into consideration, frequency division ratios to 480 kHz necessary for scaling are 0.12, 0.15, 0.18, 0.2, 0.225, 0.24, 0.3, 0.36, 0.4, 0.45, 0.5, 0.6, 0.75, 0.9 and 1.0 (15 ratios).

When only the single phase is taken into consideration, just eight ratios are necessary out of the fifteen. In this assembly, therefore, a frequency of 480 kHz is doubled or tripled for three-phase three-wire or four-wire system, and then further subjected to division of eight different ratios as are required for a single phase, and when the frequency ratio is more than 1, it is divided by ten. Thus fifteen different ratios are obtained.

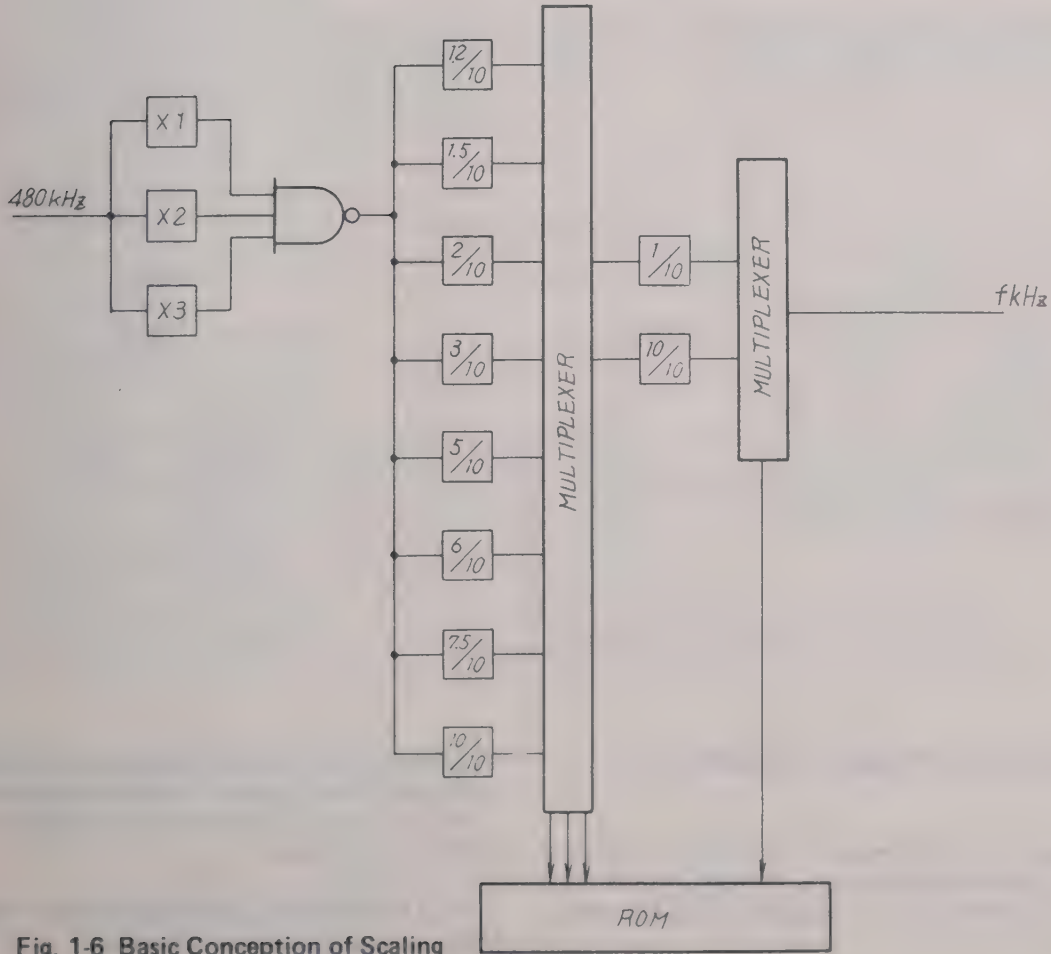


Fig. 1-6 Basic Conception of Scaling

U6 incorporated in this assembly is a ROM (Read Only Memory). As illustrated in Fig. 1-7, signals for single phase, three-phase three-wire, three-phase four-wire and single

phase (low-current: mA range) are written into it by four groups. By nominating an address (word number) externally, a signal written in it is taken out as an output.

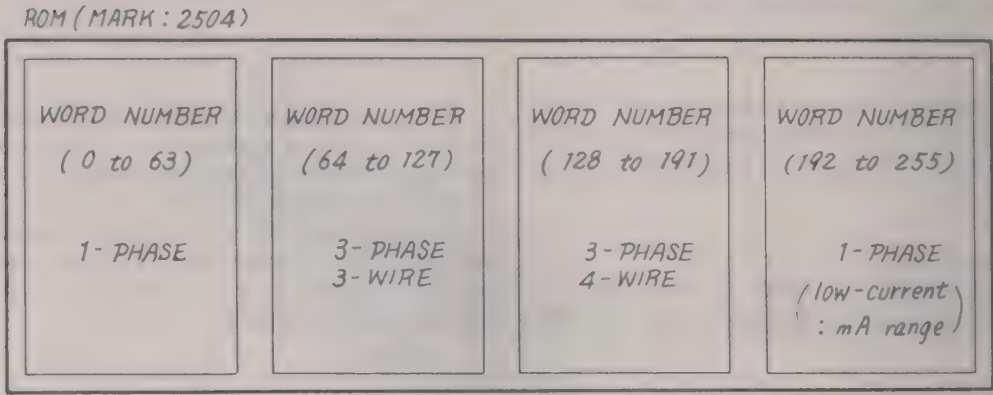


Fig. 1-7 Signals Written in ROM

As address is determined by each function switch and the range switch. An address of each range and each function is determined as given in Table 1-8.

As for selection of a voltage or current range, a voltage range is selected when all levels of address A₀ to A₂ are H, and a current range is selected when all levels of address A₃ to A₅ are H.

Table 1-8 Address

Function \ Address	Address		V Range \ Address	Address			A Range \ Address	Address		
	A ₇	A ₆		A ₅	A ₄	A ₃		A ₂	A ₁	A ₀
1-Phase	L	L	10 V	H	H	L	0.2A/1mA	H	H	L
3-Phase 3-Wire	L	H	30 V	H	L	H	0.5A/2mA	H	L	H
3-Phase 4-Wire	H	L	60 V	H	L	L	1A/5mA	H	L	L
4-Phase (low curr)	H	H	100 V	L	H	H	2A/10mA	L	H	H
			150 V	L	H	L	5A/20mA	L	H	L
			300 V	L	L	H	10A/50mA	L	L	H
			600 V	L	L	L	20A/0.1A	L	L	L

1.3.4 A/D CONVERTER Ass'y: AS B9253HJ

Converts an analog signal into a digital signal, and features capability of scaling by externally introducing a frequency, and low power consumption by an LSI used in the counter circuit.

The operating principle of this assembly is a pulse-width modulation (PWM) method in which a pulse width (T₂ - T₁) is generated in proportion to an external input Ex, which in turn is counted.

Fig. 1-8 illustrates an operating principle of this circuit, which consists of the following elements.

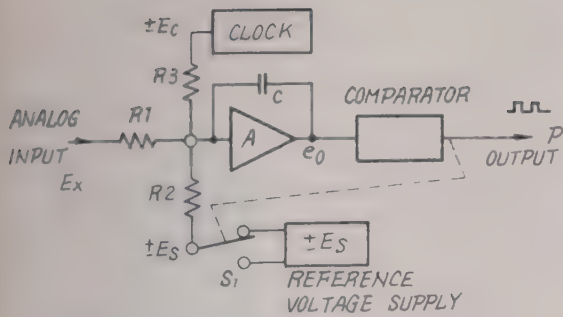


Fig. 1-8 Simplified PWM Circuit

- 1) Input voltage: E_x
- 2) Reference voltage $\pm E_s$ supply: Polarity of the reference voltage E_s is changed by electronic switch S_1 which in turn is driven by output P of the comparator.
- 3) Square-wave clock voltage $\pm E_c$ supply: Discussed later
- 4) Summing integrator: Operational amplifier A functions as a summing integrator by adding feedback capacitance C
- 5) Comparator: Compares summing integrator output e_0 with zero, and outputs pulse signal P

Input voltage E_x , reference voltage $\pm E_s$ and clock voltage $\pm E_c$ are jointly applied to the summing integrator, and its output e_0 is compared with zero. Output pulse signal P drives switch S_1 in such a manner that $+E_s$ is fed back to the integrator input when $e_0 > 0$, and $-E_s$ is when $e_0 < 0$.

The time during which switch S_1 is thrown to $+E_s$ or $-E_s$ side, or during which $+E_s$ or $-E_s$ is applied to the integrator, corresponds to the magnitude of the input voltage. It balances where its mean value is offset by E_x within one complete cycle.

Clock voltage $\pm E_c$ is a drive voltage which drives the circuit system and determines recurrent cycle T , and its dc mean value within one cycle is zero.

Fig. 1-9 depicts phase relationship between these different waveforms. (a) represents component waves E_x , $\pm E_s$ and E_c inputted to the integrator. (b) is composite waveform of the said waves which has been put together but cannot actually be observed. (c) illustrates integrator output e_0 . The zero level of the output corresponds to breakpoint of the waveform. That is, every time the waveform intersects the zero level line, the comparator switches over E_s to positive or negative. (d) is comparator output pulse P .

If the duration in which $+E_s$ is fed back is T_1 , and the duration in which $-E_s$ is fed back is T_2 as shown in Fig. 1-9, then the following formula holds, provided that the system is balanced.

$$\frac{E_x}{CR_1} (T_1 + T_2) = \frac{E_s}{CR_2} (T_2 - T_1) \dots \dots \dots (1)$$

$$E_x = E_s \left(\frac{R_1}{R_2} \right) \frac{(T_2 - T_1)}{(T_1 + T_2)} \dots \dots \dots (2)$$

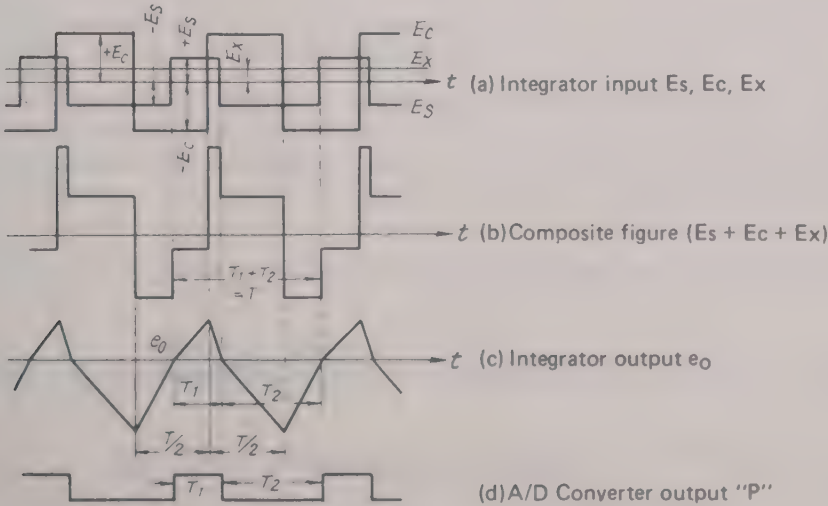


Fig. 1-9 Simplified Time Chart of PWM Circuit

$T_1 + T_2 = T$ represents a cycle of the clock signal voltage $\pm E_c$ and is kept constant. Therefore the difference of the pulse widths of E_s or $(T_2 - T_1)$ is directly proportional to input voltage level E_x . From this, analog quantity E_x is converted into a digital form by counting time $(T_2 - T_1)$.

Fig. 1-10 is a less simplified block diagram of the PWM circuit. Figs. 1-11(a) and (b) are time charts of waveforms at different positions.

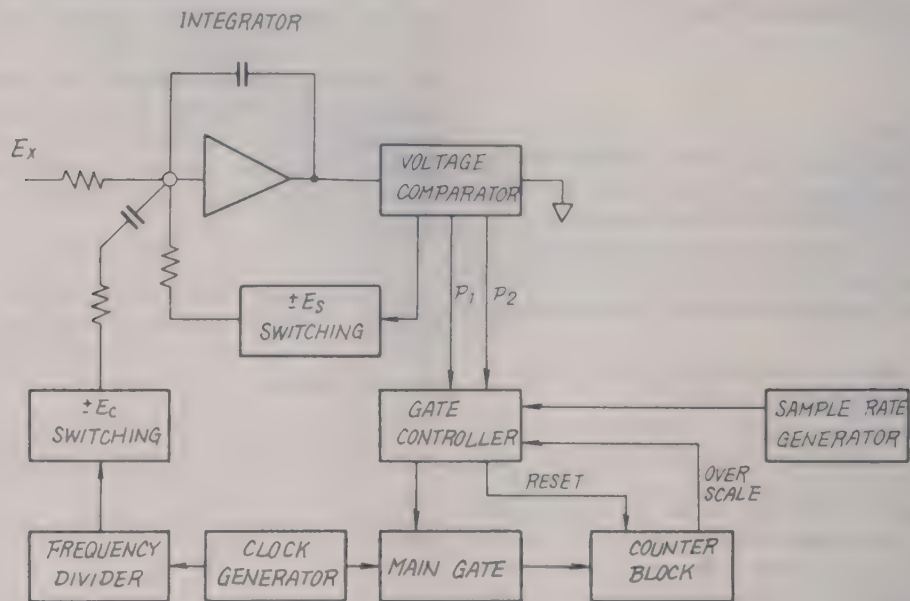


Fig. 1-10 Block Diagram of PWM Circuit

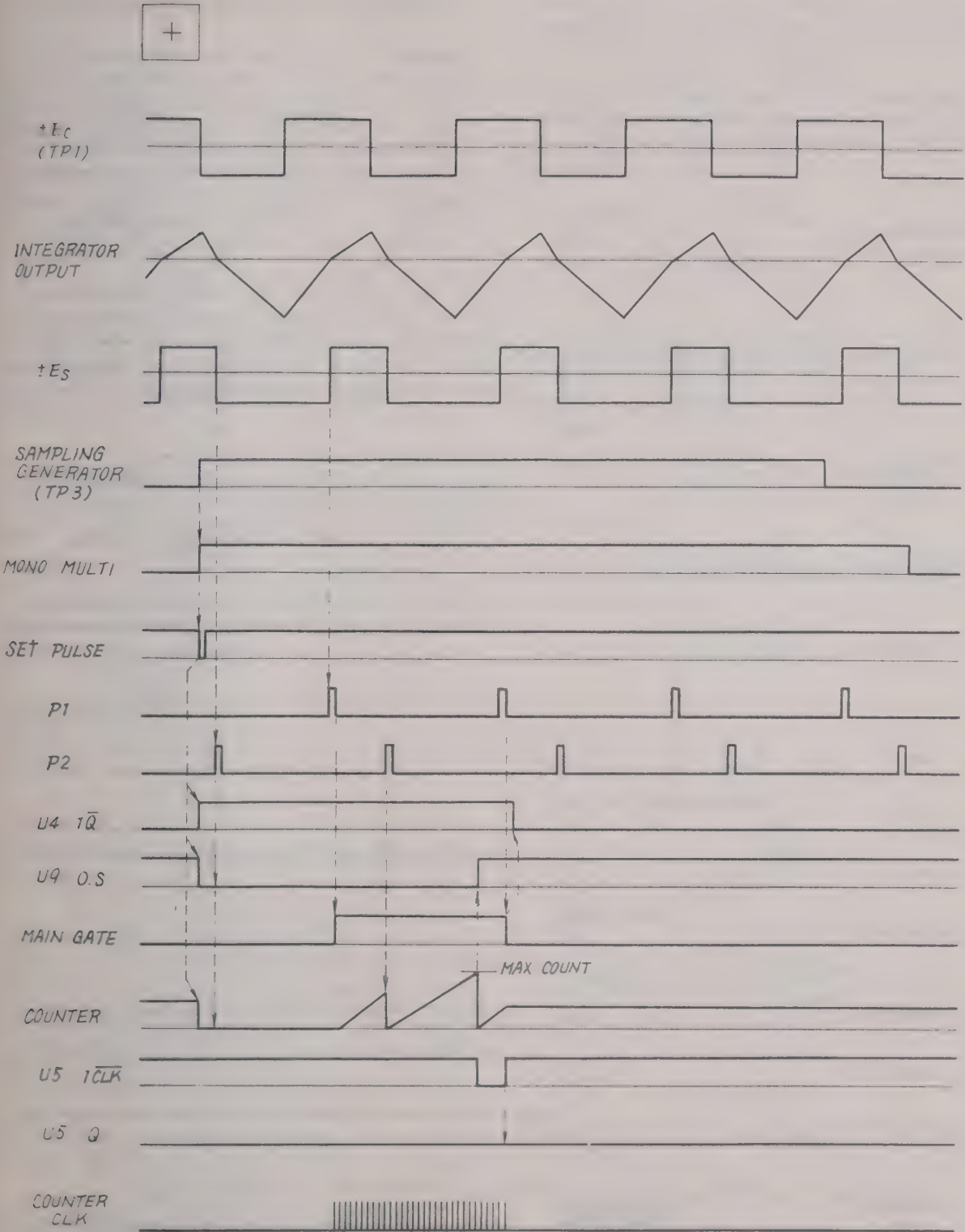


Fig. 1-11(a) Time Chart of PWM Circuit

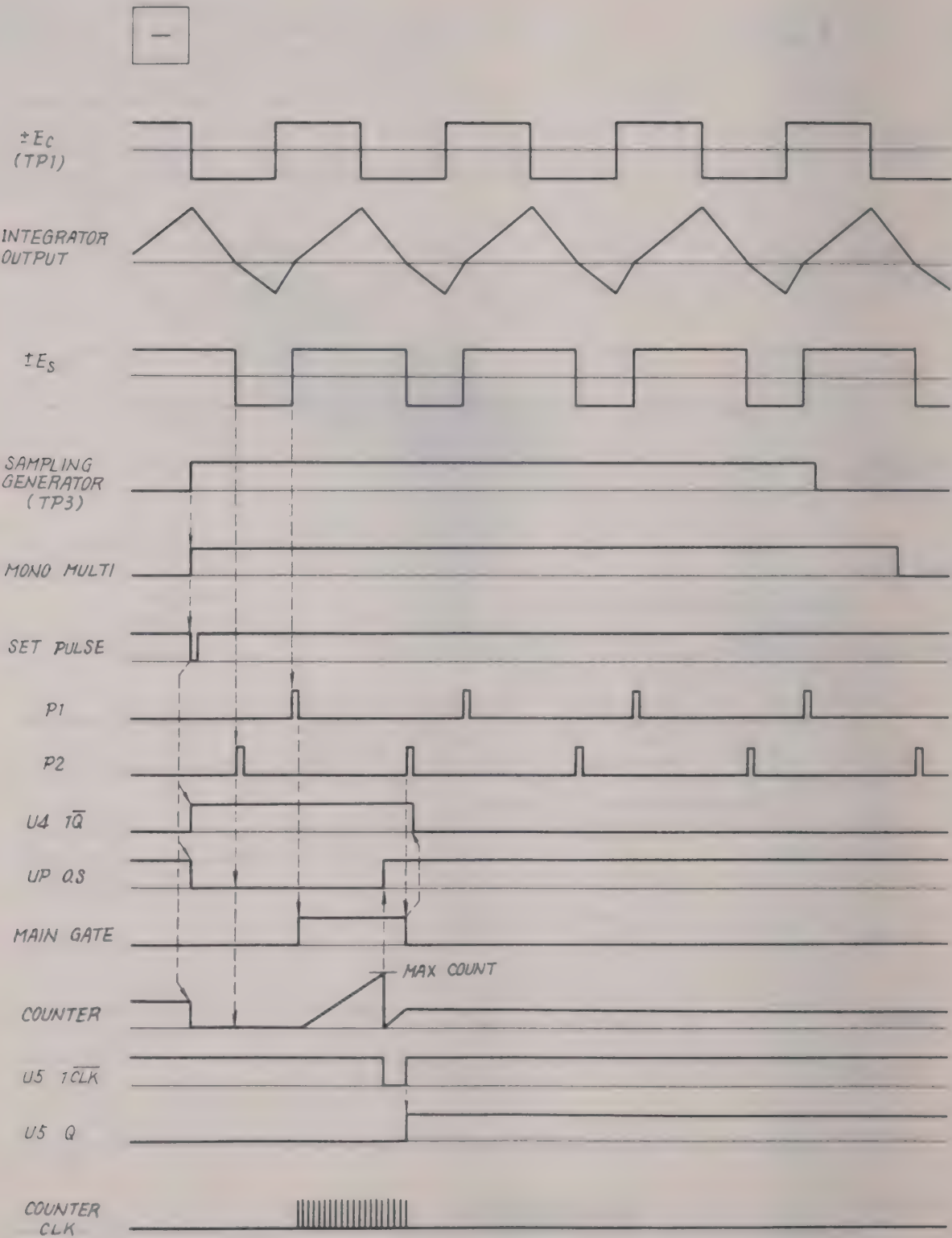


Fig. 1-11(b) Time Chart of PWM Circuit

1.3.5 DUAL RMS CONVERTER Ass'y: AS B9253HN

This assembly computes rms values of the voltage and current signals converted into 1 V rms (at rated input) by the input module, and further converts them into 5 V dc. Because this dc voltage level is in proportion to an rms value of the input signal, rms value of the input voltage or current is directly and digitally read after being subjected to scaling by the RANGING CARD Ass'y and A/D conversion by the A/D CONVERTER Ass'y.

This assembly comprises, as shown in Fig. 1-12, two completely identical rms-to-dc voltage converter circuits. One of them is used for obtaining an rms value of a voltage, and the other for an rms value of a current, thereby permitting to simultaneously obtain rms values of voltage and current.

The rms-to-dc voltage conversion is made by computation expressed as $E_{out} = \sqrt{\text{avg}(e_{in})^2}$, and this method permits obtaining a **true rms value** even of a distorted wave.

A converter making use of such computation features faster response than a thermocouple type and also strong resistance against an overinput.

The rms converter circuit employs a module IC (A9009LH), and its basic circuit is as depicted in Fig. 1-13.

The circuit basically resorts to a characteristic that voltage between transistor base and emitter V_{be} is in proportion to a logarithm of collector current I_c as expressed below.

$$V_{be} = k \cdot \log I_c \dots\dots\dots (1)$$

where k: Proportional constant

In Fig. 1-13, U1 to U4 are operational amplifiers. U1 obtains an absolute value $|E_i|$ of input voltage E_i . Collector current I_c of transistors Q1 and Q2 is proportional to $|E_i|$, output voltage E_1 of U2 is $2 \times V_{be}$, and from expression (1) above,

$$E_1 = 2 V_{be} \propto 2 \log I_c \propto 2 \log |E_i| = \log |E_i|^2 \dots\dots\dots (2)$$

is obtained.

If the output voltage of U3 is E_o , output voltage E_3 of U4 is expressed by (3).

$$E_3 \propto \log E_o \dots\dots\dots (3)$$

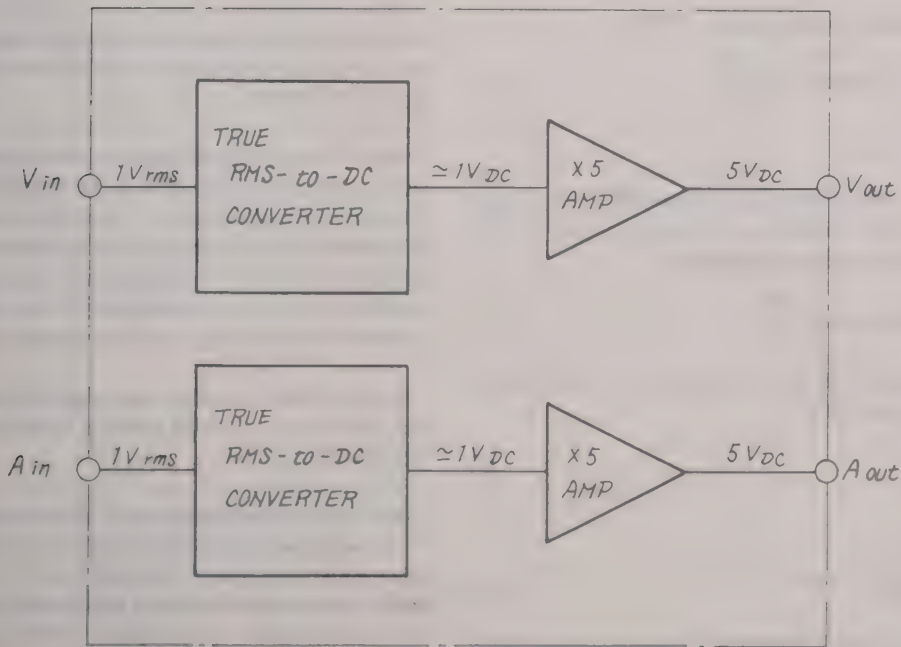


Fig. 1-12 DUAL RMS CONVERTER Ass'y: AS B9253HN

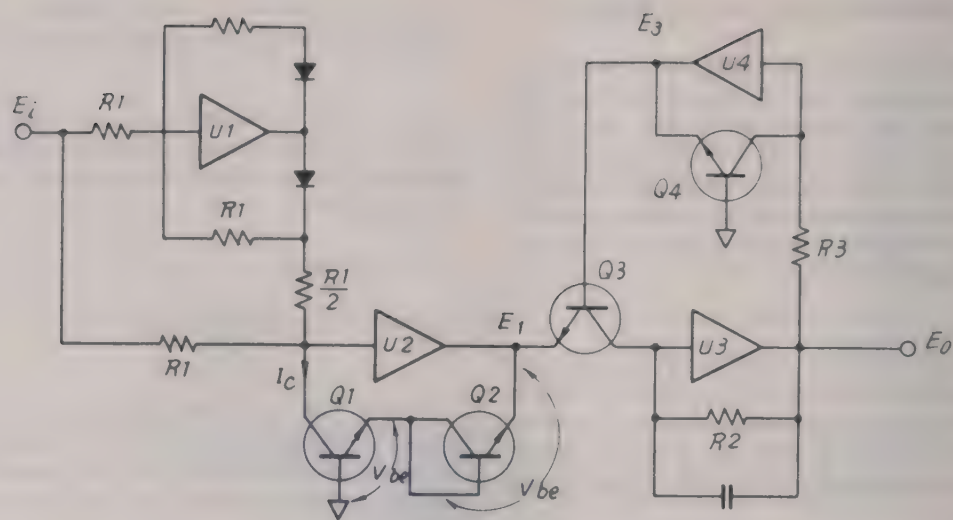


Fig. 1-13 Simplified CONVERTER Circuit

V_{be} of transistor $Q3$ is as follows from above expressions (2) and (3).

$$V_{be}(Q3) = \log |E_i|^2 - \log E_o = \log \frac{|E_i|^2}{E_o} \dots\dots\dots (4)$$

Because, from expression (1),

$$I_c \propto \exp (V_{be}) \dots\dots\dots (5)$$

is obtained, collector current $I_c(Q3)$ of $Q3$ is

$$I_c(Q3) \propto \exp \left\{ V_{be}(Q3) \right\} = \frac{|E_i|^2}{E_o} \dots\dots\dots (6)$$

is obtained.

When $I_c(Q3)$ flows through resistor $R2$, the voltage output will be E_o , which is in proportion to $I_c(Q3)$. Because $U3$'s circuit constitutes a filter,

$$E_o \propto \text{avg } I_c(Q3) \propto \text{avg } \frac{|E_i|^2}{E_o} \dots\dots\dots (7)$$

holds. By selecting the circuit resistance so that proportional constant k will be 1,

$$E_o = \text{avg } \frac{|E_i|^2}{E_o} \dots\dots\dots (8)$$

and therefore,

$$E_o = \sqrt{\text{avg } |E_i|^2} \dots\dots\dots (9)$$

holds. Thus it has been proved that output voltage E_o is obtained by computing input voltage E_i .

1.3.6 MULTIPLIER Ass'y: AS B9253HS

In this assembly, a voltage and a current both converted into 1 V rms (at rated inputs) by the input module are multiplied into 5 V dc. The dc voltage which is proportional to the power (voltage x current x power factor) is directly and digitally read after being subjected to the ranging and A/D conversion by the aforementioned RANGING CARD Ass'y and A/D CONVERTER Ass'y respectively.

The assembly consists of a feedback time division multiplier which resorts to a principle that the area of an electric pulse train is obtained by its pulse width multiplied by its pulse height.

Fig. 1-14 is a block diagram of this multiplier. The upper section comprising $U1$ through $U4$ constitutes a feedback PWM circuit as discussed in 1.3.4 A/D CONVERTER Ass'y. A voltage input from terminal X is pulse-width-modulated as stated in 1.3.4 to obtain from $U4$ a pulse having a duration which is proportional to the voltage input in question. Thus the pulse width has been determined.

In the lower section comprising $U31$ through $U33$, on the other hand, the pulse height is determined by a current inputted to terminal Y.

By closing a switching circuit of the input from terminal Y in accordance with the duration of pulse from $U4$, a pulse which has a width proportional to the voltage input and a height proportional to the current input is obtained or, in other words, multiplication is effected. Thus the area of the pulse, or the power, has been found.

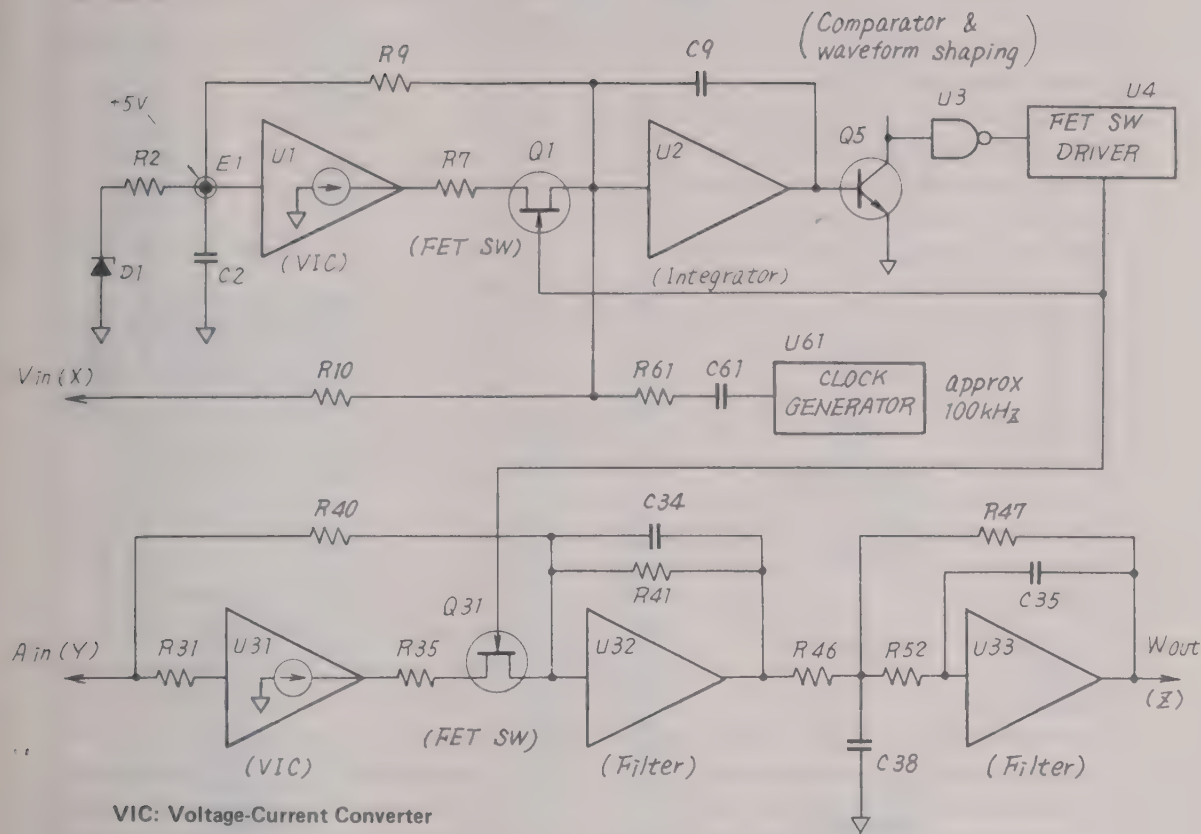


Fig. 1-14 MULTIPLIER Block Diagram

1.3.7 BCD OUTPUT CARD Ass'y: AS B9253YA

Mainly gives and takes data to and from an external circuit. The serial BCD signal from the A/D CONVERTER Ass'y is converted into a parallel form to permit the signal to be sent out externally.

A decimal-point signal from the RANGING CARD Ass'y, and a unit signal from the FUNCTION switch on the front panel also pass through this assembly before being sent out externally as decimal-point and unit outputs.

For these signals, refer to Table 1-9 BCD OUTPUT Connector Signals.

By applying function, V-range, and A-range signals as control signals from the CONTROL INPUT connector, remote setting of the function and ranges is available.

For these signals, refer to Table 1-10 CONTROL INPUT Connector Signals.

Table 1-9 BCD OUTPUT Connector Signals

BCD OUTPUT CONNECTOR						
		26	1	1	x 10 ⁰	BCD OUTPUT
		27	2	2		
		28	3	4		
		29	4	8		
		30	5	1	x 10 ¹	
		31	6	2		
UNIT OUTPUT	(mA)	32	7	4		
	A	33	8	8		
	V	34	9	1	x 10 ²	
	W	35	10	2		
	kW	36	11	4		
	37	12	8			
OVERRANGE		38	13	1	x 10 ³	
		39	14	2		
-- (MINUS)		40	15	4		
		41	16	8		
POINT OUTPUT	Pt1	42	17	1	x 10 ⁴	
	Pt2	43	18			
	Pt3	44	18			
	Pt4	45	20			
		46	21			
BUSY		47	22			
END PULSE		48	23			
DIG. COM.		49	24	EXT. START		
+5V		50	25	EXT. HOLD		

	Signal	Level		Data
		"L"	"H"	
INPUT	EXT. START EXT. HOLD	0 to 0.5V	2.4 to 5V	L
OUTPUT	BCD, OVER, UNIT, DEC Pt, -- (MINUS)	0 to 0.5V	2.4V min.	H
	BUSY	0 to 0.5V	2.4V min.	L
	END PULSE	0 to 0.5V	2.4V min.	L

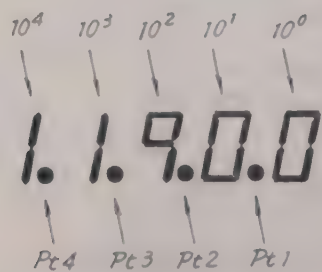


Table 1-10 CONTROL INPUT Connector Signals

CONTROL INPUT Connector					
A Range	20A/0.1A	26	1	600V	V Range
	10A/50mA	27	2	300V	
	5A/20mA	28	3	150V	
	2A/10mA	29	4	100V	
	1A/5mA	30	5	60V	
	0.5A/2mA	31	6	30V	
	0.2A/1mA	32	7	10V	
		33	8		
EXT. FUNCTION SEL.		34	9	PWM	
EXT. RANGE SEL.		35	10	f (scale freq.)	
UPPER/LOWER SEL.		36	11	480 kHz	
		37	12		
UNIT OUTPUT	mW	38	13	W (1φ) V A	FUNCTION
		39	14		
		40	15		
		41	16		
		42	17		
		43	18		
		44	19		
		45	20		
		46	21		
BUSY		47	22		
END PULSE		48	23		
DIG. COM.		49	24	EXT. MAN	
+5 V		50	25	EXT. HOLD	

Note: scale freq (in kHz) = (480 x full-scale value of relevant range)/1000

	Signal	Level		Data
		"L"	"H"	
Input	EXT. START	0 ~ 0.5 V	2.4 ~ 5 V	L
	EXT. HOLD	0 ~ 0.5 V	2.4 ~ 5 V	L
	EXT. FUNCTION SEL.	0 ~ 0.5 V	2.4 ~ 5 V	L
	EXT. RANGE SEL.	0 ~ 0.5 V	2.4 ~ 5 V	L
	UPPER/LOWER SEL.	0 ~ 0.5 V	2.4 ~ 5 V	L
	V/A RANGE, FUNCTION	0 ~ 0.5 V	2.4 ~ 5 V	L
Output	UNIT OUTPUT	0 ~ 0.5 V	2.4 V min.	H
	BUSY	0 ~ 0.5 V	2.4 V min.	L
	END PULSE	0 ~ 0.5 V	2.4 V min.	L

- Note: 1. V and A ranges are externally selectable by setting EXT. RANGE SEL. to "L".
2. UPPER/LOWER SEL. is a signal which selects high or low current according to open or "H" condition, or "L" condition respectively.
3. Function is externally selectable through EXT. FUNCTION SEL.

2.TEST,CALIBRATION AND ADJUSTMENT

2.1 Description

This chapter concerns test and calibration of the Type 2504 Digital AC Meter, and adjustment of its component assemblies.

To maintain specifications stated in 2.2, the Type 2504 should be tested and calibrated periodically like other precision measuring instruments. The simplest and most dependable way to calibrate the Type 2504, therefor, may be to ask a testing authority which is endowed with traceability to the national standards the same as for standard cells and resistors. If calibration by such an authority is not feasible, the Type 2504 can be tested and calibrated by the procedures stated in 2.4.

When it is necessary to adjust the instrument after the above test and calibration, or when a part mounted on an assembly has been replaced due to a trouble, adjust the affected assembly referring to a relevant section of 2.5, and then carry out an overall test of the instrument.

2.2 Specifications

Function		Voltage	Current	Power
Spec. Item				
Operating Principle		Logarithmic Conversion	Logarithmic Conversion	Feedback Time Division Multiplier
Rated Input*	2514-01	100 V	5 A	500 W
	2514-02	150 V	5 A	750 W
	2514-06	30/60/100/150/300 V	0.5/1/2/5/10 A	15 W ~ 3 kW
	2514-07	100/150/300/600 V	2/5/10/20 A	200 W ~ 12 kW
Resolution*	2524-01	10mV/digit	1mA/digit	100mW/digit
	2514-02	100mV/digit	1mA/digit	100mW/digit
	2514-06	10mV/digit	100μA/digit	10mW/digit
	2514-07	10mV/digit	1mA/digit	100mW/digit
Frequency Range		25 Hz ~ 2 kHz	25 Hz ~ 2 kHz	40 Hz ~ 1.2 kHz
Crest Factor		Within 2 at rated value	Within 3 at rated value	Combination of V, I functions
Accuracy at: Ambient temp 23 ± 3°C Power Source 100 ± 1 V Input sine-wave, 90-day calibration cycle		47 ~ 63 Hz: ± (0.25% of rdg + 0.05% of range) 25 ~ 47 Hz and 63 Hz ~ 2 kHz: ± (0.5% of rdg + 0.1% of range) Except that when input module 2514-07 is used, 25 ~ 47 Hz and 63 Hz ~ 1.5 kHz: ± (0.5% of rdg + 0.1% of range)	47 ~ 63 Hz: ± (0.25% of rdg + 0.05% of range) 25 ~ 47 Hz and 63 Hz ~ 2 kHz: ± (0.5% of rdg + 0.1% of range)	At cos φ = 1 47 ~ 63 Hz: ± (0.25% of rdg + 0.05% of range) 40 ~ 47 Hz and 63 Hz ~ 1.2 kHz: ± (0.5% of rdg + 0.1% of range) Influence of power factor: Within ± 0.25% of range at cos φ = 0.5, 47 ~ 63 Hz, according to JIS $\pm 0.1102\% \text{ of range } \phi < 90^\circ$
Temp Characteristic at: 5 ~ 20°C, 26 ~ 40°C 47 Hz ~ 1 kHz		Within ±0.05% of range/°C	Within ±0.05% of range/°C	Within ±0.025% of range/°C
Instrument Loss at 50 Hz		Ca 5 kΩ at 30-V range	Ca 0.05 VA at 0.5-A range	Combination of voltage and current functions
		Ca 20 kΩ at 60-V range	Ca 0.07 VA at 1-A range	
		Ca 50 kΩ at 100-V range	Ca 0.1 VA at 2-A range	
		Ca 100 kΩ at 150-V range	Ca 0.4 VA at 5-A range	
		Ca 500 kΩ at 300-V range	Ca 1 VA at 10-A range	
		Ca 1.5 MΩ at 600-V range	Ca 2 VA at 20-A range	
Max. Continuous Allowable Input		3 times range	3 times range	Combination of voltage and current functions
Max. Continuous Allowable Common-Mode Voltage at 50/60 Hz		1000 V	1000 V	
Max. Instantaneous Allowable Input within 1 s		3.5 times range	10 times range	
Influence of Common-Mode Voltage at 50/60 Hz		CMRR 80 dB min, at 1000 V between voltage input terminals connected together and case	Within ±0.025% of range at 1000 V between current input terminals and case	Within ±0.025% of range at 1000 V between voltage and current input terminals or between input terminal and case

* : Rated input and resolution differ according to combined input module (Type 2514-□□).

Input type	: Floating
Display	: LED
Sample rate	: Approx 1.5 per second
Max. display	: 11900
Range selection	: Manual
Function selection	: Manual

Remote control optionally available for unit indication and scaling. Remote control for measured values necessitates an external selector switch.

Units displayed	: V, (mA), A, W, kW
Effective measuring range	: 30 to 110% of rated value
Response time	: Approx 2 s (for reading within specified accuracy against abrupt input variation from 30 to 100% of range or from 100 to 30%)
Operating temperature	: 5 to 40°C
Operating humidity range	: 20 to 80%, relative humidity
Warmup time	: Approx 30 minutes for reading within accuracy

Data output

- Standard : Analog output (simultaneous outputs for each function), accuracy within $\pm 0.25\%$ of rated value, 5 V dc output at rated input, max. load current 5 mA, load capacitance within 0.05 μF
- Option : BCD (1-2-4-8) code, unit symbols, decimal-point and overrange signal.

Power requirements : 100 $\pm$ 10 V ac, 50/60 Hz (115, 200, 215, 230 V ac available upon request)

Influence by power fluctuation: Within $\pm 0.05\%$ of range against power voltage fluctuation of $\pm 10\%$

Dielectric strength :

- 2200 V, 50/60 Hz,
1 min between input terminals and case
- 2200 V, 50/60 Hz,
1 min between input and output terminals
- 1500 V, 50/60 Hz,
1 min between power circuit and case
- 1500 V, 50/60 Hz,
1 min between power circuit and output terminals

Insulation resistance	: 50 M Ω min. at 500 V dc
Power consumption	: Approx 22 VA
External dimensions	: Approx 149 x 228 x 365 mm
Weight	: Approx 9 kg fully equipped

2.3 Rewiring of Power Transformer Primary Winding and Replacement of Fuse for Power Voltage Change

The power transformer primary is wired according to the source voltage as illustrated in Fig. 2-1. If the instrument is to be operated by another voltage, rewire the primary winding as depicted. A 1-A fuse is employed for 100/115 V, and a 0.5-A fuse is employed for 200/215/230 V.

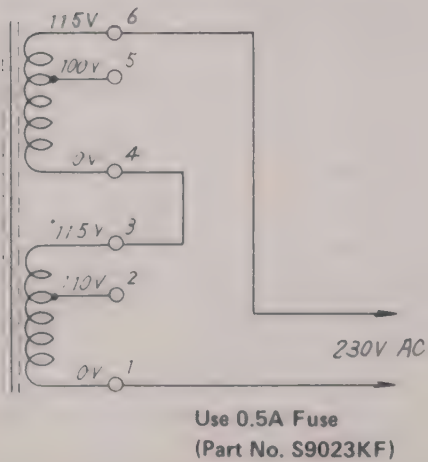
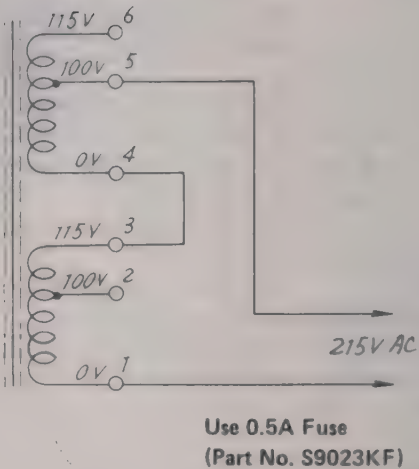
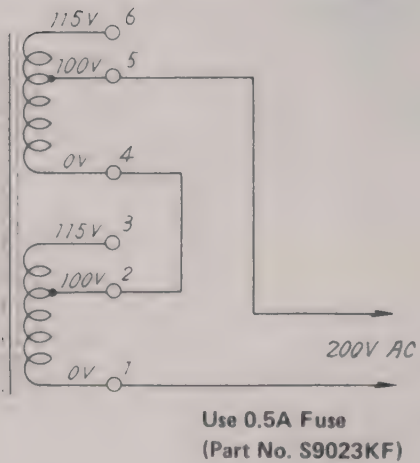
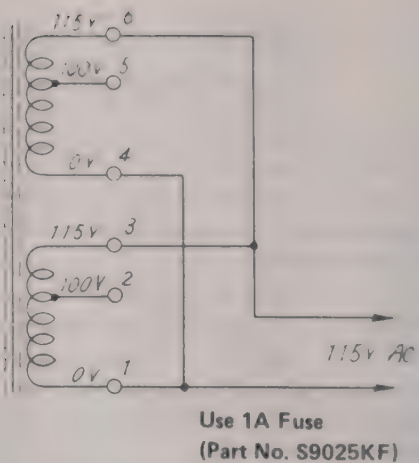
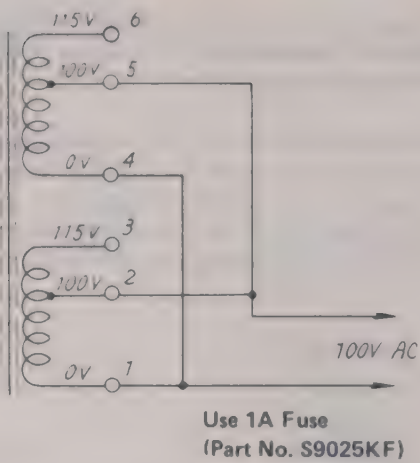


Fig. 2-1 Tip Connection of Power Transformer

2.4 Test and Calibration

Have the instrument calibrated periodically by a testing authority endowed with traceability to the national standards. When carrying out test or calibration yourselves, employ the following instruments having dependable accuracy or other instruments equivalent to them.

YEW will not be responsible for troubles caused by using improper testing instruments.

Because high voltages and currents are involved, handle the instrument with extreme care so as not to cause accidents.

2.4.1 Testing instruments (or equivalents)

- YEW Type 3213-03 Battery-Operated Insulation Resistance Tester (500 V/100 MΩ)
- Nitsuko Model 2911 Dielectric Strength Tester (0 to 5 kV ac, dc)
- hp Model 745A + 746A AC Voltage Calibration System
- OPTIMATION PA250K Power Amplifier
- Matsushita Model VP-721 Generator (with main and quad outputs)
- JOHN FLUKE Model 931B True-RMS Differential Voltmeter
- YEW Type 2837 Resistive-Load Unit for Type 2805 (0.2 Ω ± 0.05%, 5W)
- Current transformer as stated subsequently
- YEW Type 2885-S43 Standard Watt Converter (Type 2885-11 with voltage and current ranges adapted for testing Type 2504)
- YEW Type 2805 Digital Integrating Voltmeter
- YEW Type 2862-3 Phase Shifter
- OPTIMATION PA 250M Power Amplifier
- Potential transformer as stated subsequently
- AC voltage regulator (0 to 120 V)

Reference: Current and potential transformers

All the above measuring instruments are available on the market except the current and potential transformers which you should manufacture or have manufactured by a specialist to the following specifications.

Current transformer	
Primary rated current	 5 A
Secondary rated current	 0.5, 1, 2, 5, 10, 20 A
Operating frequency	 25 Hz to 2 kHz
Secondary burden	 Approx 4 VA
Ratio error	 Within ±0.05%
Dielectric strength	 2 kV ac, 1 min between primary and secondary.

For the core, Senpermax [molybdenum(5%)-nickel(79%)-iron alloy] wound core manufactured by Tohoku Kin-zoku or an equivalent is recommended.

Potential transformer	
Primary rated voltage	 100 V
Secondary rated voltage	 30, 60, 100, 150, 300, 600 V
Operating frequency	 25 Hz to 2 kHz
Secondary burden	 Approx 1 VA
Ratio error	 Within ±1%
Dielectric strength	 2 kV ac, 1 min between primary and secondary.

2.4.2 Testing items and procedure

Functions, measurement items and ranges of the instrument depend upon selected combination of a Type 2504-□□ AC Meter Assembly and Type 2514-□□ Input Module Assembly. Therefore, carry out tests for items which correspond to the functions, measurement items and ranges.

For simplicity's sake, combination of both assemblies above will hereinafter be called the Type 2504.

Accuracy mentioned in each test item below corresponds to standard conditions (ambient temperature 23 ± 3°C, ambient humidity 45 to 75% RH, power source voltage 100 V ± 1%, sine-wave input, 90-day calibration cycle).

- A. Insulation resistance and dielectric strength
- Test the insulation resistance and dielectric strength as given in Table 2-1 by means of the insulation resistance tester and dielectric strength tester.

Table 2-1

	Insulation Resistance	Dielectric Strength (50/60 Hz, 1 min)
	Test Conditions	Test Conditions
Between:		
Each input terminal and case	500 V dc, 50 MΩ min.	2,200 V
Each input terminal and each output terminal	500 V dc, 50 MΩ min.	2,200 V
Each input terminal and power circuit	500 V dc, 50 MΩ min.	1,500 V
Each output terminal and power circuit	500 V dc, 50 MΩ min.	1,500 V
Voltage and current terminals	500 V dc, 50 MΩ min.	2,200 V

B. Voltage range

B-1 Voltage range display

Test full-scale indications at each voltage range on the Type 2504 in test conditions given in Table 2-2 by applying sine-wave voltages to the voltage input terminal of the Type 2504 using the ac voltage calibration system.

B-2 Voltage range linearity

Set the Type 2504 to 100-V range, and successively apply voltages given in Table 2-3, and take readings on the Type 2504.

C. Current range

C-1 Current range display

Constitute a test setup as shown in Fig. 2-2 using the

generator, power amplifier, resistive-load unit, differential voltmeter and current transformer.

Make output adjustment of the PA250K so that its output current will be exactly 5 A, or the Model 931B will exactly display 1 V, and apply sine-wave currents to the current input terminal of the Type 2504 while checking by the Model 931B whether the output fluctuates or not. Test full-scale indications on each current range in conditions stated in Table 2-4.

The instrument can be calibrated to within $\pm 0.15\%$ at worst and $\pm 0.087\%$ generally, because accuracy of the Model 931B, Type 2837 and current transformer is within $\pm 0.05\%$.

Table 2-2

Range		30V	60V	100V	150V	300V	600V
Applied Voltage (V)		30.0000	60.0000	100.0000	150.000	300.000	600.000
Reading	Fixed freq. between 47 and 63 Hz						
	2 kHz						
Accuracy	47 ~ 63 Hz	$\pm (0.25\% \text{ of rdg} + 0.05\% \text{ of range})$					
	25 ~ 47 Hz	$\pm (0.5\% \text{ of rdg} + 0.1\% \text{ of range})$					
	63 Hz ~ 2 kHz						

Table 2-3
(At any fixed frequency between 47 and 63 Hz)

Applied Voltage (V)	110.000	100.0000	80.0000	60.0000	40.0000	30.0000
Reading						
Accuracy	$\pm (0.25\% \text{ of rdg} + 0.05\% \text{ of range})$ between 30 and 110% of range					

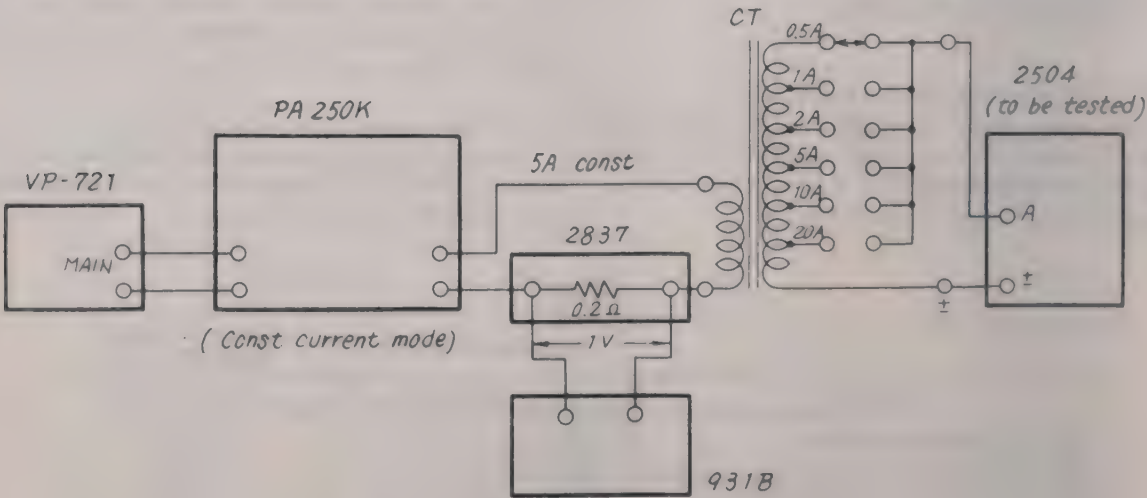


Fig. 2-2 Wiring for Test of Current Range

Table 2-4

Range		0.5A	1 A	2 A	5 A	10 A	20A
Applied Current* (A)		0.5	1	2	5	10	20
Reading	Fixed freq between 47 and 63 Hz						
	2 kHz						
Accuracy	47 ~ 63 Hz	$\pm (0.25\% \text{ of rdg} + 0.05\% \text{ of range})$					
	25 ~ 47 Hz	$\pm (0.5\% \text{ of rdg} + 0.1\% \text{ of range})$					
	63 Hz ~ 2 kHz						

* : The applied current refers to that at the output terminal of the current transformer after the above current adjustment.

Table 2-5
(At any fixed frequency between 47 and 63 Hz)

Applied Current* (A)	1.1	1.0	0.8	0.6	0.4	0.3
Reading (A)						
Accuracy	$\pm (0.25\% \text{ of rdg} + 0.5\% \text{ of range})$ between 30 and 110% of range					

* : The applied current refers to that at the 1-A terminal of the current transformer after the above current adjustment.

C-2 Current range linearity

In the same setup as above, set the current range of the Type 2504 to 1 A, and the selector switch of the current transformer to 1 A.

Make output adjustment of the PA250K so that the Model 931B will display exactly 1.1 V, 1.0 V, 0.8 V, 0.6 V, 0.4 V and 0.3 V, and take readings on the Type 2504 as given in Table 2-5.

D. Power

Constitute a setup for testing wattage as depicted in Fig. 2-3 using the generator, power amplifiers, standard watt converter and so on.

Accuracy of the test setup is determined solely by the Type 2885-S43 and Type 2805. Because their accuracy is approximately $\pm 0.02\%$ and $\pm 0.01\%$ respectively, the overall accuracy will be approximately $\pm 0.03\%$ at the worst, and generally $\pm 0.025\%$.

For detailed explanation on the operating principle and setup for wattage test, refer to a service manual for the Type 2885-11 Standard Watt Converter.

D-1 Wattage display

- a. Current fixed to 1 A, $\cos \varphi = 1$
Set the current range selector of the Type 2504 to 1 A.
Connect the 1-A and $\pm$ terminals of the Type 2885-S43 and the current input terminals of the Type 2504 in series as illustrated, and further connect them to the 1-A and $\pm$ terminals of the current transformer. This connection is not altered during this procedure.

Then set the voltage range selector of the Type 2504 to 30 V, and connect the 30-V and $\pm$ terminals of the Type 2885-S43 and the voltage input terminals of the Type 2504 in parallel with the 30-V and $\pm$ output terminals of the potential transformer.

Adjust outputs of the PA250M and PA250K so that readings on the Model 931B connected to the potential-transformer primary and the Type 2837 will be exactly 100 V and 1 V for the voltage and current sides respectively.

Apply a sine-wave ac voltage of 30 V and a sine-wave ac current of 1 A in phase to the Types 2885-S43 and 2504 respectively. Check the full-scale display of the wattage range (voltage: 30 V, current: 1 A, or wattage: 30 W) on the Type 2504 under test against the output of the Type 2885-S43 or the display on the Type 2805.

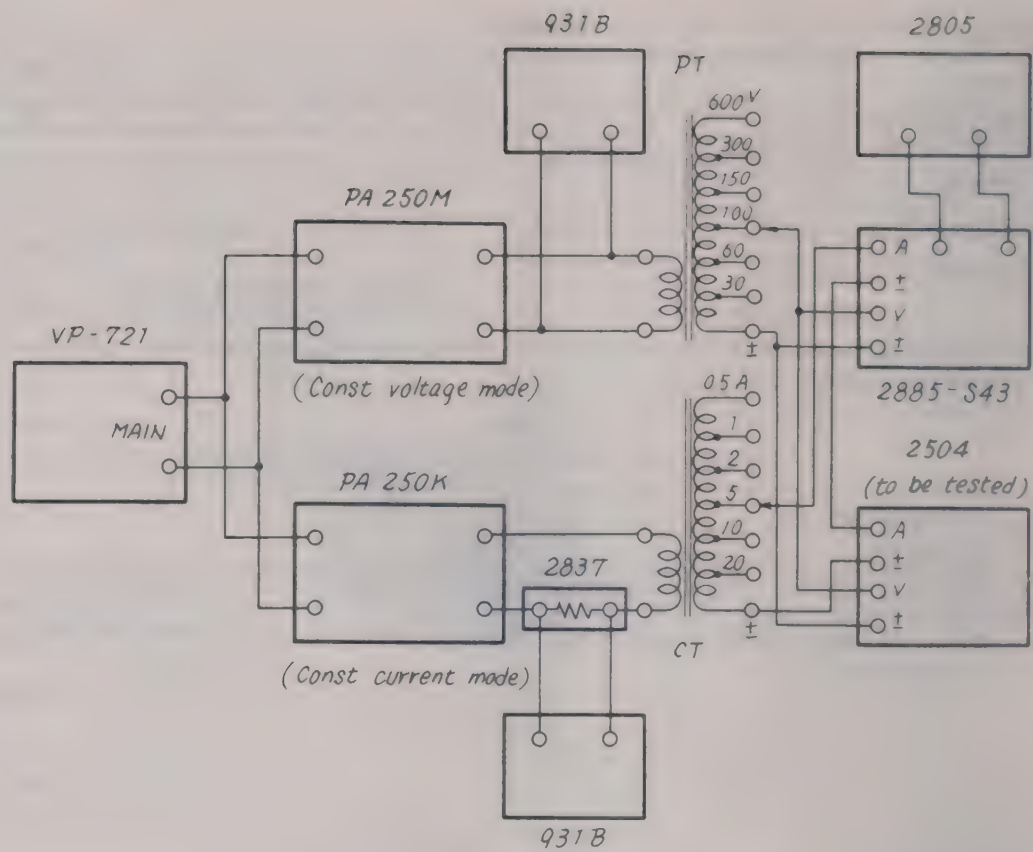


Fig. 2-3 Wiring for Test of Wattage Range

Table 2-6

Voltage Range and Applied Voltage (V)		30	60	100	150	300	600
Wattage Range (W)		30	60	100	150	300	600
Reading on 2805 (W)	Fixed freq between 47 and 63 Hz						
	1.2 kHz						
Reading on 2504 (W)	Fixed freq between 47 and 63 Hz						
	1.2 kHz						
Accuracy	47 ~ 63 Hz	$\pm (0.25\% \text{ of rdg} + 0.05\% \text{ of range})$					
	25 ~ 47 Hz	$\pm (0.5\% \text{ of rdg} + 0.1\% \text{ of range})$					
	63 Hz ~ 1.2 kHz						

In the same way, check the full-scale display at 60 V, 100 V, ... and 600 V successively by switching over the voltage to the Types 2885-S43 and 2504 by means of the potential transformer taps referring to Table 2-6.

b. Voltage fixed to 100 V, $\cos \varphi = 1$

Set the voltage range selector of the Type 2504 to 100 V. Connect the 100-V and $\pm$ terminals of the Type

2885-S43 and the voltage input terminals of the Type 2504 in parallel with the 100-V and $\pm$ terminals of the potential transformer. This connection is not altered during this procedure.

Then set the current range selector of the Type 2504 to 0.5 A, and connect the 0.5-A and $\pm$ terminals of the Type 2885-S43 and the current input terminals of the Type 2504 in series, and further connect them to the 0.5-A and $\pm$ terminals of the current transformer.

Table 2-7

Current Range and Applied Current* (A)		0.5	2	5	10	20
Wattage Range (W)		50	200	500	1000	2k
Reading on 2805 (W)	Fixed freq between 47 and 63 Hz					
	1.2 kHz					
Reading on 2504 (W)	Fixed freq between 47 and 63 Hz					
	1.2 kHz					
Accuracy	47 ~ 63 Hz	$\pm (0.25\% \text{ of rdg} + 0.05\% \text{ of range})$				
	25 ~ 47 Hz	$\pm (0.5\% \text{ of rdg} + 0.1\% \text{ of range})$				
	63 Hz ~ 1.2 kHz					

* : 1-A range is omitted because it has already been tested in a. above.

As stated before, adjust outputs of the PA250M and PA250K so that readings on the Model 931B connected to the voltage and current sides will be exactly 100 V and 1 V.

Apply sine-wave voltage and current of 100 V and 0.5 A in phase to the Type 2885-S43 and Type 2504 respectively. Check the full-scale display of the wattage range (voltage: 100 V, current: 0.5 A, or wattage: 50 W) on the Type 2504 under test against the display on the Type 2805.

In the same way, check the full-scale display at 2 A, 5 A, ... and 20 A successively by switching over the current to the Types 2885-S43 and 2504 by means of the current transformer taps referring to Table 2-7.

D-2 Wattage linearity

a. Voltage range 100V, applied voltage varied, current range 1A, applied current fixed to 1A, fixed frequency between 47 and 63Hz, $\cos \varphi = 1$.

Set the voltage and current range selectors of the Type 2504 to 100 V and 1 A respectively.

Connect the 1-A and $\pm$ current input terminals of the Type 2885-S43 and the current input terminals of the Type 2504 in series, and further connect them to the 1-A and $\pm$ terminals of the current transformer.

Connect the 100-V and $\pm$ terminals of the Type 2885-S43 and the voltage input terminals of the Type 2504 in parallel with the 100-V and $\pm$ terminals of the potential transformer.

Adjust output of the PA250K so that reading on the Model 931B connected to the current side will be exactly 1 V.

Adjust outputs of the PA250M successively so that readings on the Model 931B connected to the voltage side will be exactly 110 V, 100 V, ..., 40 V and 30 V.

Test the wattage linearity by checking readings on the Type 2504 against those on the Type 2805 by applying voltage and current simultaneously.

Table 2-8

Applied Voltage (V)	110	100	80	60	40	30
Wattage (W)	110	100	80	60	40	30
Reading on 2805 (W)						
Reading on 2504 (W)						
Accuracy	$\pm (0.25\% \text{ of rdg} + 0.05\% \text{ of range})$ between 30 and 110% of range					

Table 2-10

Voltage Range and Applied Voltage (V)		30	60	100	150	300	600
Wattage Range (W)		30	60	100	150	300	600
Reading on 2504 (W)	Current in lead						
	Current in lag						
Accuracy		± 0.145% of range					

Using the Type 2862-3, set the current 90° in lead or lag of the voltage, and apply the voltage and current to the Types 2885-S43 and 2504 simultaneously for each of the cases in the same procedure as in D-1 a. Wattage display.

Finely adjust the Type 2862-3 to 90° or 270° so that reading on the Type 2805 will be a minimum, or the voltage and current will be exactly 90° out of phase. Test the zero power factor characteristics by the reading on the Type 2504 at these times.

F. Influence of common-mode voltage

Using the Models 745A and 746A, apply an ac voltage of the same frequency as the commercial power as given in Table 2-11. Test the influence by a common-mode voltage through variation of readings on the Type 2504.

Table 2-11

Voltage Range	CMRR 80 dB min. (at 1000 V between shorted voltage input terminals and case)
Current Range	Within ±0.025% of range (at 1000 V between current input terminal and case)
Wattage Range	Within ±0.025% of range (at 1000 V between voltage and current terminals or between input terminal and case)

G. Influence by power source voltage fluctuation

Apply a rated voltage of 100 V across the voltage terminal the same as in the test of B-1 Voltage range display, and take reading on the Type 2504. Then vary the power source voltage to ±10% from the rated voltage, and take readings. Compare the latter readings with the former.

Then, apply a rated current of 1 A or a rated power of 100 W the same as in the test of C-1 Current range display and D-1 Wattage display (a.), and take readings on each. Then vary the values to ±10% from the rated values, and take readings. Compare the latter readings with the former for each of the current and wattage measurements.

Accuracy: Within ±0.05% of range against power source voltage fluctuation of ±10%

H. Functions

Test the following functions during the above tests.

- H-1 Maximum display: 11900 or higher
- H-2 Decimal point, units and overrange display
- H-3 Sample rate: Approx 1.5 per second, HOLD action and manual command
- H-4 Voltage and current range selecting action
- H-5 Function selecting action
- H-6 Analog output (Refer to Table 2-12)
- H-7 BCD output (option)

Table 2-12

Pin No.	Signal	Accuracy
1	V out	5 V dc ± 0.3% at rated input
2	A out	
3	W out	
6	A channel	Approx 1 V rms at rated input
13	V channel	
14	P.G.	

Thus the Type 2504 has been tested.

When calibration is necessary, obtain values to be corrected based on test reports issued by testing authorities relevant to each test instrument.

If an error exceeding the accuracy stipulated in the specifications has been found as a result of the testing and calibration procedures discussed heretofore, perform overall readjustment in the following procedures, and confirm the operation by carrying out tests again.

2.5 Adjustment

2.5.1 Case removal

Pull out the DISPLAY UNIT and INPUT MODULE toward you after loosening three panel lock screws located on the lower section of their front panels by turning them counterclockwise, and then removing two screws located on the bottom rear of the case.

2.5.2 Adjustment of PCB Assemblies and INPUT MODULE

A. Adjusting instruments

For adjusting the PCB Assemblies and INPUT MODULE, measuring instruments given in Table 2-13 or equivalents are required.

B. Adjustment of POWER SUPPLY Ass'y: AS B9253HA

Procedure

- 1. Keep the POWER SUPPLY Ass'y engaged in position (J102) in the Type 2504, and allow it an approximately 10-minute warmup.
- 2. Connect the Type 2501 between test points (+15 V) and (PG) located at the upper section of the assembly. Adjust R4 to obtain reading of +15 V ± 0.05 V.
- 3. Reconnect the Type 2501 between (-15 V) and (PG) and adjust R7 to obtain reading of -15 V ± 0.05 V.

Table 2-13

Ass'y Instrument	POWER SUPPLY (B9253HA)	DISPLAY (B9253EH)	A/D CONVERTER (B9253HJ)	DUAL RMS (B9253HN)	MULTIPLIER (B9253HS)	INPUT MODULE (2514-□□)	RANGING CARD (B9253HE)	BCD OUTPUT (B9253YH)
YEW Type 2501 Precision Digital Voltmeter	○			○	○			
Test card (1): See Fig. 2-6		○						
Test card (2): See Fig. 2-7		○						
Oscilloscope			○	○	○			
YEW Type 2552 DC Voltage Standard			○	○	○			
hp Model 745A + 746A AC Voltage Calibration System				○	○	○		
hp Model 8004A Pulse Generator				○				
JOHN FLUKE Model 931B True-RMS Differential Voltmeter				○				
hp Model 203A Variable-Phase Generator					□			
Power factor test set: See Fig. 2-4						○		
Wattage display test set: See Fig. 2-3							○	
BCD OUTPUT test set: See Figs. 2-17a, b								○

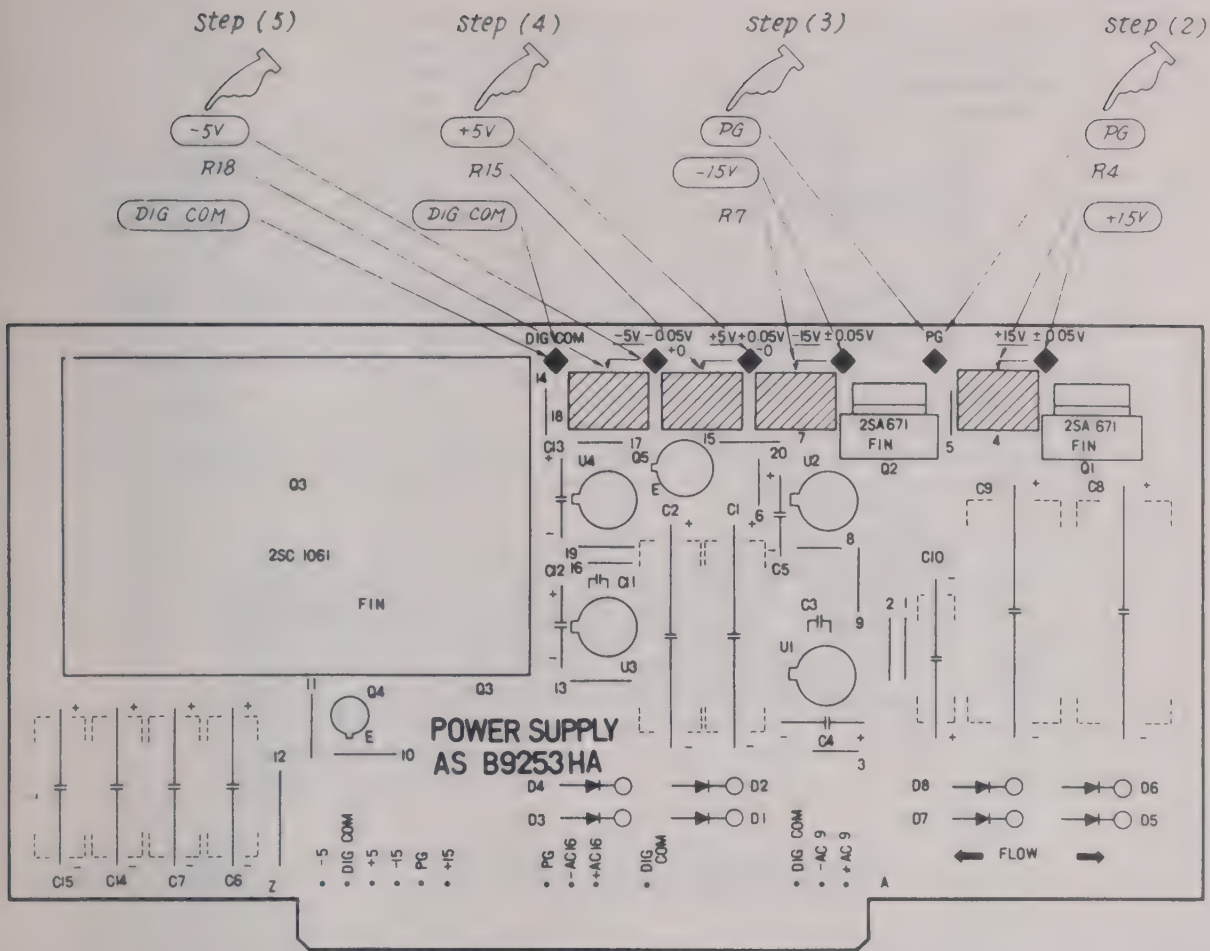


Fig. 2-5 POWER SUPPLY Ass'y Adjustment Procedure

4. Adjust R15 so that the voltage between test points $\boxed{+5V}$ and $\boxed{DIG.COM.}$ will be $+5V_{-0}^{+0.05V}$
5. Finally adjust R18 so that the voltage between $\boxed{-5V}$ and $\boxed{DIG.COM.}$ will be $-5V_{-0.05V}^{+0}$

For locations of the above test points and adjuster rheostats, see Fig. 2-5 POWER SUPPLY Ass'y Adjustment Procedure.

C. Operation check of DISPLAY Ass'y: AS B9253EH

Normally this assembly needs no adjustment. It is only necessary to check display of the LEDs for numerals and lamp for units.

It is recommended to manufacture the following test cards for such operation checks.

Test card (1): For numeral check, typically illustrated in Fig. 2-6

Test card (2): For point and unit check, typically illustrated in Fig. 2-7

The shown test cards are representative ones. It is recommended to devise and build simpler yet efficient cards to suit your particular requirements.

Procedure

1. Engage the DISPLAY Ass'y with connector J101 of the Type 2504 equipped with the POWER SUPPLY Ass'y adjusted in the above procedure.

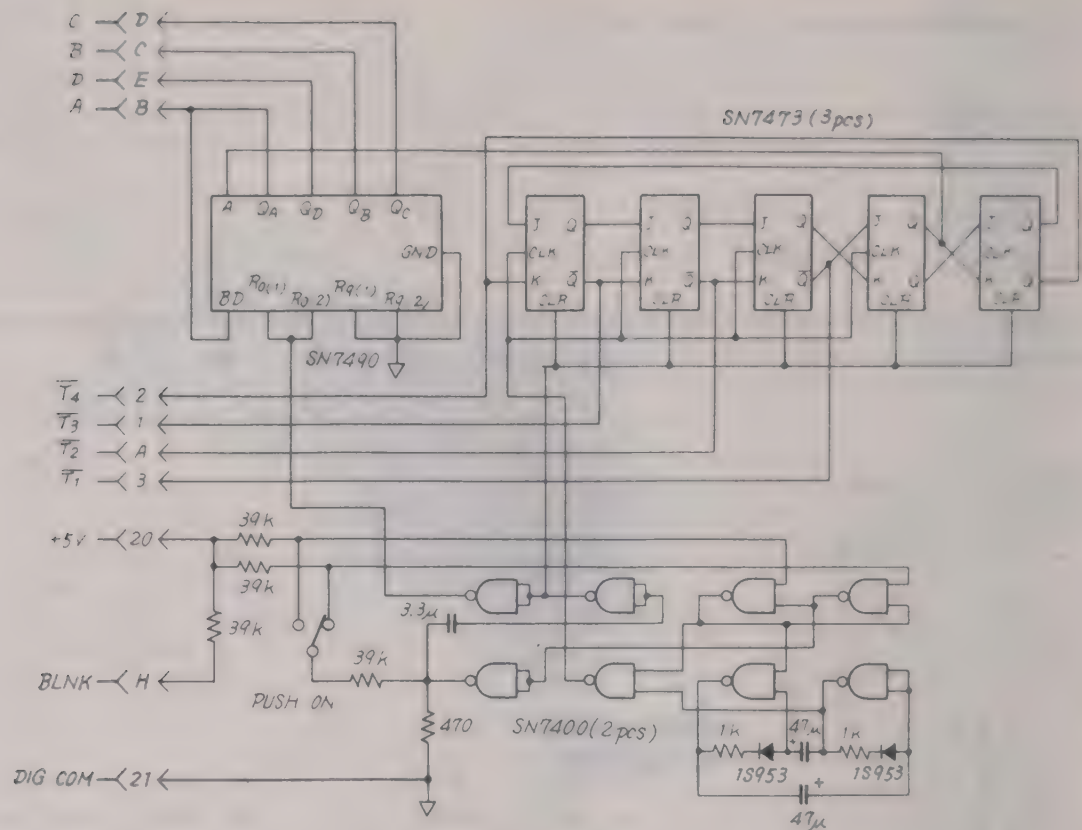


Fig. 2-6 Circuit Diagram of Test Card (1)

2. Engage test card (1) with J105, and turn ON the POWER switch of the Type 2504.

3. Confirm that, by depressing a pushbutton switch on the test card, each numeral LED illuminates successively as shown below.
4. Remove test card (1), and engage test card (2) with J103. Confirm that, by depressing a pushbutton switch on the test card, each decimal-point LED and unit lamp illuminates successively.

D. Adjustment of A/D CONVERTER Ass'y: AS B9253HJ

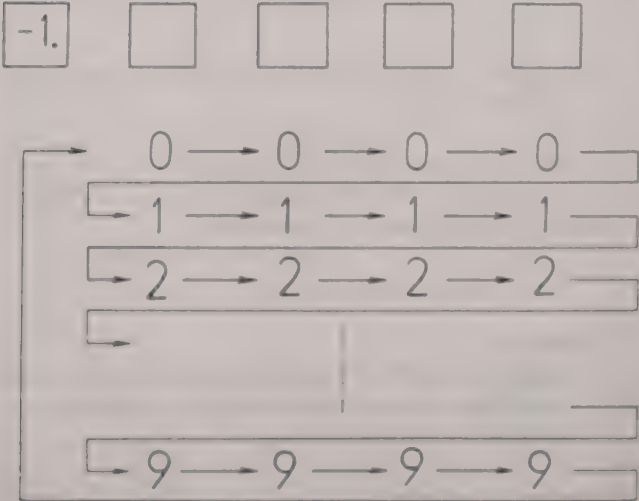
Procedure

1. After the above procedure, remove test card (2), and engage the A/D CONVERTER Ass'y with J105 by way of the 44P extender board (Type 2503-P44).

2. Allow an approximately 10-minute warmup by turning on power.

3. Connect the oscilloscope between test points (TP1) and (DIG.COM). Confirm that a 10-Hz square wave is observed as shown at (TP1) of Fig. 2-8.

4. Then observe a waveform between (TP3) and (DIG.COM). Confirm that it is a square wave of approximately 1.5 Hz as illustrated at (TP3) of Fig. 2-8:



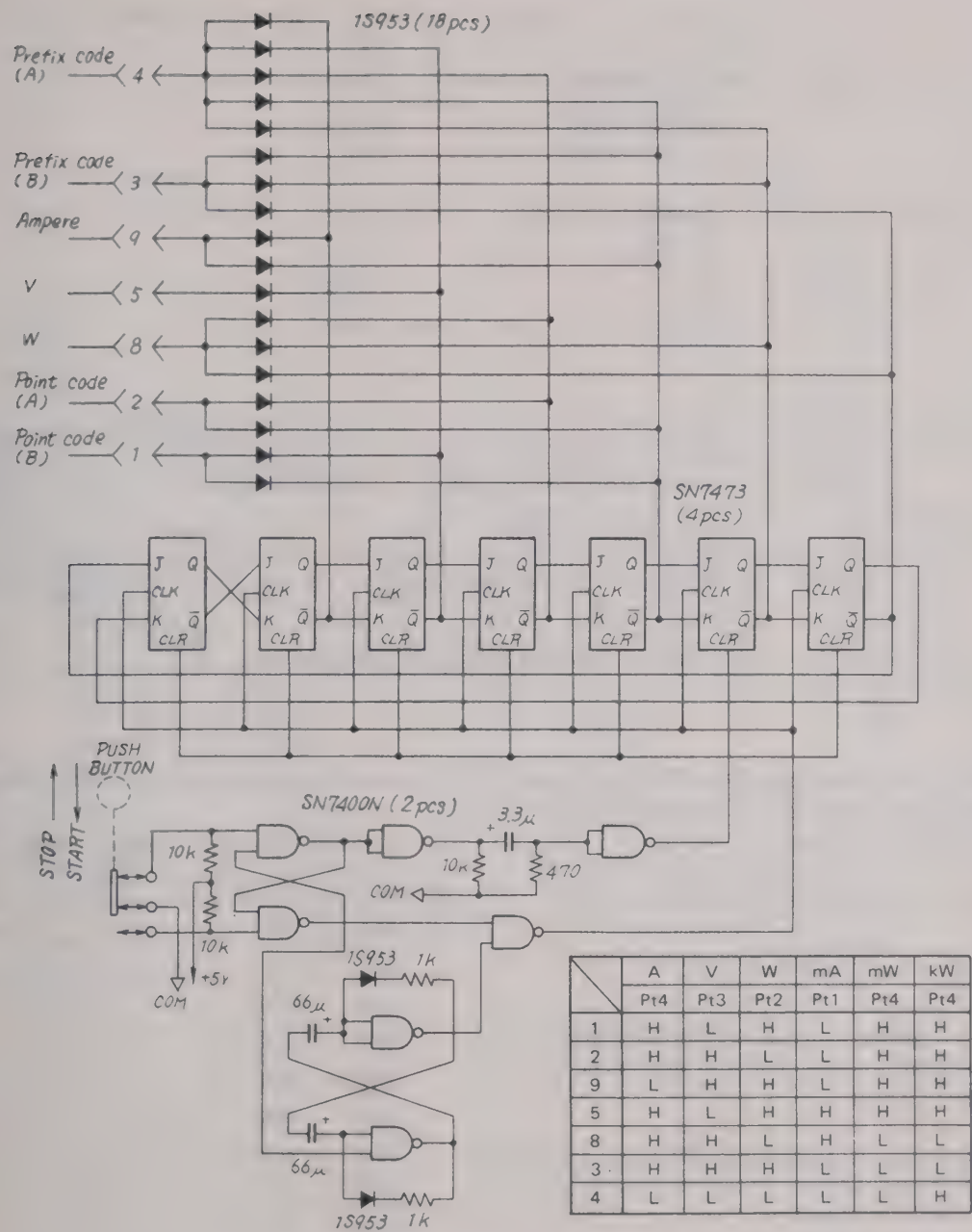


Fig. 2-7 Circuit Diagram of Test Card (2)

- Observe a waveform between (TP4) and (DIG.COM). Confirm that it is a square wave having a zero level with duration of 250 to 300 ms as illustrated at (TP4) of Fig. 2-8.
- Short-circuit extender board pins leading to connector pins (15/S) (A/D INPUT) and (18/V) (P.G.), and adjust R24 (ZERO ADJ) to obtain reading of 0.0000 on the Type 2504.
- Remove the above shorting, apply +5.00000 V between pins (15/S) and (18/V) by the Type 2552, and adjust R19 (F.S.ADJ) to obtain minimum reading on the Type 2504.
- Cut a jumper or jumpers between f.s. adjusting test points corresponding to the reading obtained above referring to Table 2-14.

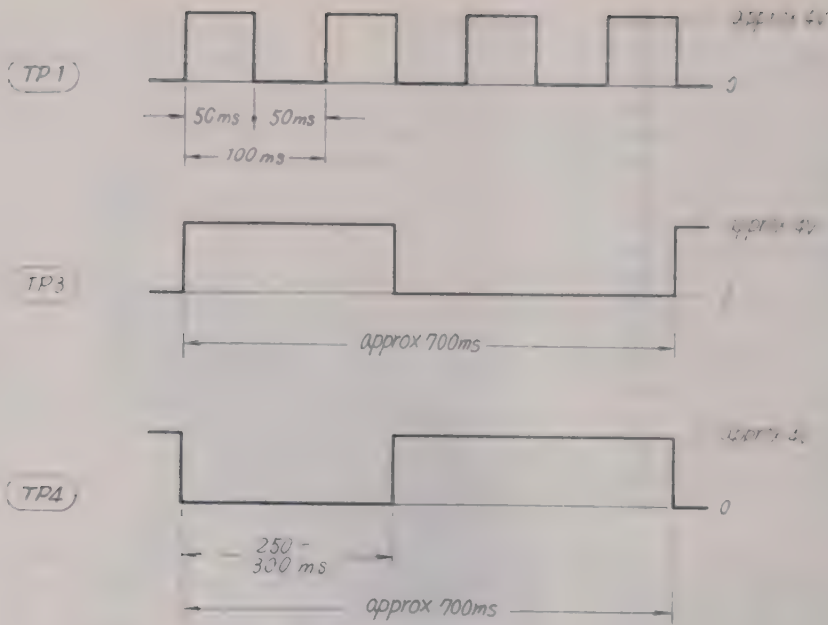


Fig. 2-8 Waveforms of TP1, TP3 and TP4

9. After the above step, adjust R19 to obtain reading of 1.0000 on the Type 2504. Variable range by R19 is approximately 120 digits.
10. Readjust zero by R24 referring to step 6 above.
11. Readjust full scale by R19 referring to steps 7 and 9 above
12. Apply -5.00000 V between (15/S) and (18/V) by the Type 2552. Confirm that the Type 2504 displays -1.0000 ± 1 digit.
13. Confirm that overscale condition of the Type 2504 occurs at approximately -1.1950 as the output of the Type 2552 is increased.

For locations of the above test points and adjuster rheostats, see Fig. 2-9 A.D CONVERTER Ass'y Adjustment Procedure.

Table 2-14 Resistance Adjustment by Cutting Jumper(s)

Jumper Wire				
Reading on Type 2504	A	B	C	D
1.0000 - .9900				
.9900 - .9840	X			
.9840 - .9770		X		
.9770 - .9700	X	X		
.9700 - .9650			X	
.9650 - .9580	X		X	
.9580 - .9530		X	X	
.9530 - .9480	X	X	X	
.9480 - .9420				X
.9420 - .9360	X			X
.9360 - .9300		X		X
.9300 - .9250	X	X		X
.9250 - .9200			X	X
.9200 - .9140	X		X	X
.9140 - .9100		X	X	X
.9100 - .9010	X	X	X	X
Approx increase of rdg by cutting jumper(s)	60	120	240	480

X indicates cut jumper(s) on Pcb ass'y

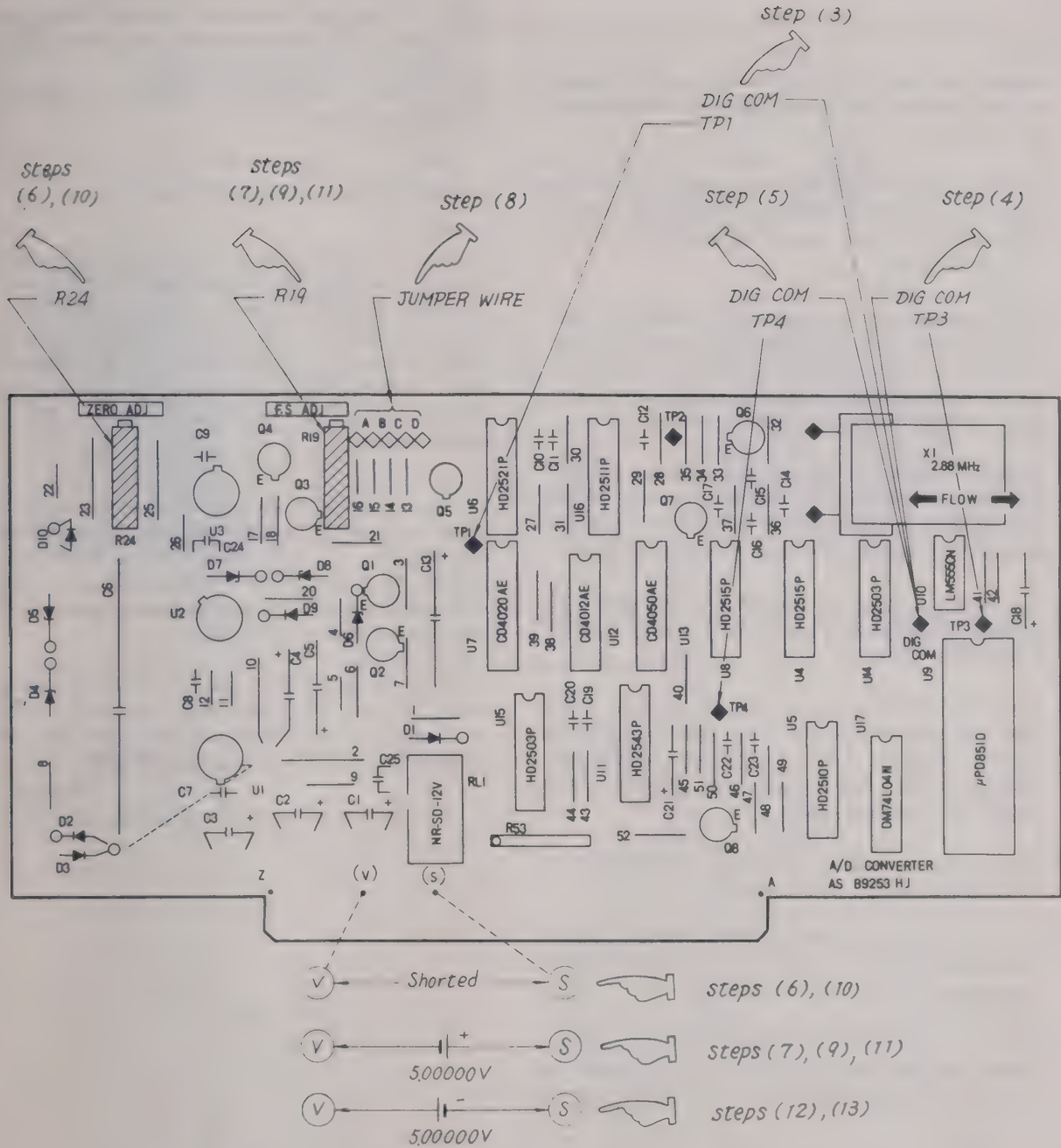


Fig. 2-9 A/D CONVERTER Ass'y Adjustment Prosedure

E. Adjustment of DUAL RMS CONVERTER Ass'y: AS 89253HN

Because it is desirable to adjust this assembly in an ambient temperature equivalent to actual instrumentation, it is preferable to apply an input voltage to the PCB-Ass'y through a connecting cable specially designed for this purpose rather than through the extender board employed previously. Manufacture the connecting cable for test referring to Fig. 2-10. The cable is also usable for adjusting

the Type 2514-□□ Input Module singly, and the Type 2504-□□ and Type 2514-□□ combinedly. Thus the cable is worth having.

a) F.S. adjustment and linearity test

Procedure

1. Connect the cable for test between the input module and the connector for it mounted on the rear panel of the mainframe.
2. With the A/D CONVERTER Ass'y adjusted in step D kept mounted, engage the DUAL RMS CONVERTER Ass'y with J106, and allow them an approximately 20-minute warmup.
3. Apply 1.00000 V by the Type 2552 between terminals (9) (Vin) and (10) (S.G.) on the intermediate check terminal board of the said cable, and adjust R9 [V.F.S.] so that the Type 2501 connected between test points (TP2) and (S.G.) will indicate 5.0000 V $\pm$ 4 mV.
4. Invert the polarity of the applied voltage, and confirm that the Type 2501 indicates 5.0000 V $\pm$ 4 mV. If it is not satisfied, readjust R9 until the specified accuracy is satisfied regardless of the polarity of the applied voltage.
5. Then apply a voltage of +100.000 mV, and adjust R10 [V.ZERO] so that the Type 2501 will indicate 0.50000 V $\pm$ 1 mV.
6. Invert the polarity of the applied voltage, and confirm that the indication of the Type 2501 is within the specified accuracy. If it is not satisfied, readjust R10 until the specified accuracy is satisfied regardless of the polarity of the applied voltage.
7. Repeat steps 3 through 6 until all the specifications are satisfied because they are interdependent.
8. Test the linearity by varying applied voltages in 200-mV steps between 0 to 1 V and 0 to -1 V. Confirm that values given in Table 2-15 are satisfied.
9. Adjust and test the RMS CONVERTER circuit of the current side referring to steps 3 through 8 above by applying voltages between terminals (21) (Ain) and

(10) (S.G.) on the intermediate terminal of the cable, and reading output voltages between test points (TP22) and (S.G.) by means of the Type 2501.
At this time, rheostats R29 [A.F.S.] and R30 [A.ZERO] are adjusted.

b) Frequency characteristics and ac linearity test

Procedure

1. Connect the Model 745A between intermediate terminals (9) (Vin) and (10) (S.G.) of the cable. Apply an ac voltage of 1.000000 V with its frequency varied to 25, 50/60 and 400 Hz, and 2 and 20 kHz successively. Check the frequency characteristics of the voltage-side RMS CONVERTER circuit at each of the above points by means of Type 2501. For their specifications, refer to Table 2-16.
2. In the same set up as in 1 above, set the frequency to 50/60 Hz, and vary the input voltage to 0, 200.000 mV, 400.000 mV, ... and 1000.000 mV in 200-mV steps. Confirm that CONVERTER output voltages or Type 2504 readings against the applied voltages are within the accuracy specified in Table 2-15.
3. Connect the Model 745A between intermediate terminals (21) and (10) of the cable. Test the frequency characteristics and linearity of the current-side RMS CONVERTER referring to steps 1 and 2 above.

Table 2-15 Linearity Specifications

2552 Setting (mV)	0	200.000	400.000	600.000	800.000	1000.000
745A Setting (Vrms)	0	0.200000	0.400000	0.600000	0.800000	1.000000
2501 Reading (V)	0.00000 $\pm$ 20mV	1.00000 $\pm$ 1.4mV	2.0000 $\pm$ 2.1mV	3.0000 $\pm$ 2.8mV	4.0000 $\pm$ 3.5mV	5.0000 $\pm$ 4.2mV
2504 Reading (normalized)	0.0000 $\pm$ 28 digits	0.2000 $\pm$ 3 digits	0.4000 $\pm$ 4 digits	0.6000 $\pm$ 6 digits	0.8000 $\pm$ 7 digits	1.0000 $\pm$ 8 digits

Accuracy : (0.1% of rdg + 0.02% of f.s.) $\times$ 0.7

Table 2-16 Frequency Characteristics Specifications

Frequency (Hz)	25	50/60	400	2k	20k
2501 Reading (V)	5.0000 ±9.0mV	5.0000 ±4.2mV	5.0000 ±4.2mV	5.0000 ±4.2mV	5.0000 ±4.2mV
2504 Reading (normalized)	1.0000 ±18 digits	1.0000 ±8 digits	1.0000 ±8 digits	1.0000 ±8 digits	1.0000 ±8 digits

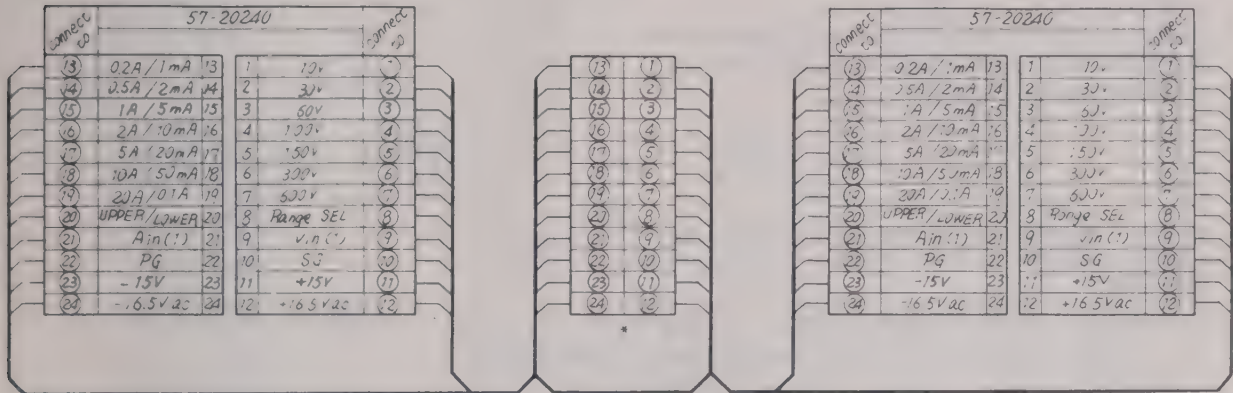


Fig. 2-10 Connecting Cable for Test

* INTERMEDIATE CHECK
TERMINAL BOARD

c) Crest factor test

Procedure

1. Connect each instrument as shown in Fig. 2-11.

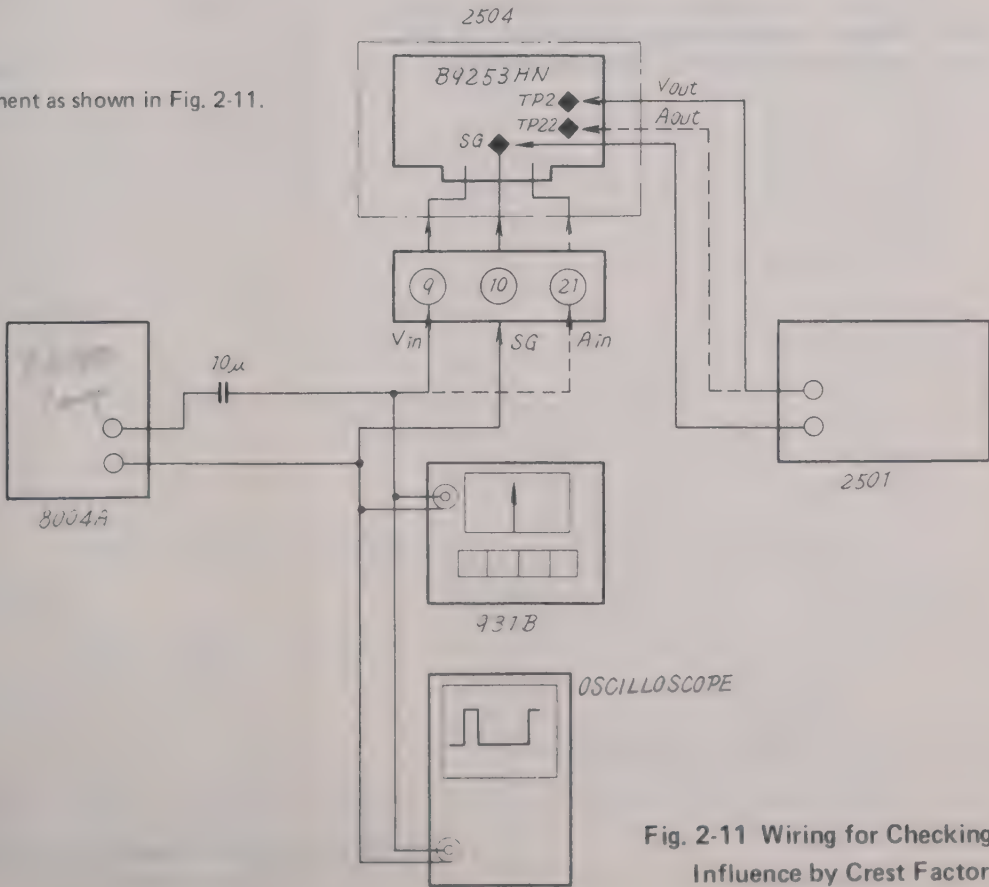


Fig. 2-11 Wiring for Checking
Influence by Crest Factor

- 2. Set the basic cycle time of the Model 8004A to 20 ms.
- 3. Confirm through output voltages of the CONVERTER or readings on the Type 2504 that influence by crest factors is within the specifications in Table 2-17 by varying the pulse width to 10 ms (crest factor = 1), 2 ms (c.f. = 3), 0.77 ms (c.f. = 5) and 0.4 (c.f. = 7) with the output of the Model 8004A adjusted so that the reading on the Model 931B will always be 1 V rms.
- 4. Rewire the Model 8004A to (21) and (10), and test influence by crest factors on the current-side RMS CONVERTER referring to 3 above.

spec. calibration

Table 2-17 Specifications of Influence by Crest Factor

Crest Factor	1	(3)	5	7
2501 Reading (V)	5.0000 ±4.2mV	5.0000 ±7.7mV	5.0000 ±10.5mV	5.0000 ±12.3mV
2504 Reading (normalized)	1.0000 ±8 digits	1.0000 ±15 digits	1.0000 ±21 digits	1.0000 ±25 digits

For locations, settings and connections of the above test points, adjuster rheostats and instruments, see Fig. 2-12 DUAL RMS CONVERTER Ass'y Adjustment Procedure.



Reference

1. Crest factor calculating formula and graph

$$C = \sqrt{\frac{1 - D}{D}}$$

where D: Duty cycle
In Figs. 2-13 and 2-14, D = t/T

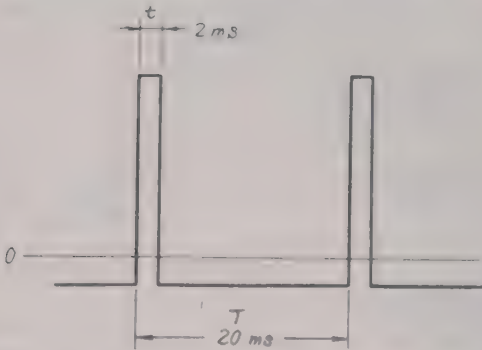


Fig. 2-13 Waveform of Pulse Having Duty Cycle of 0.1

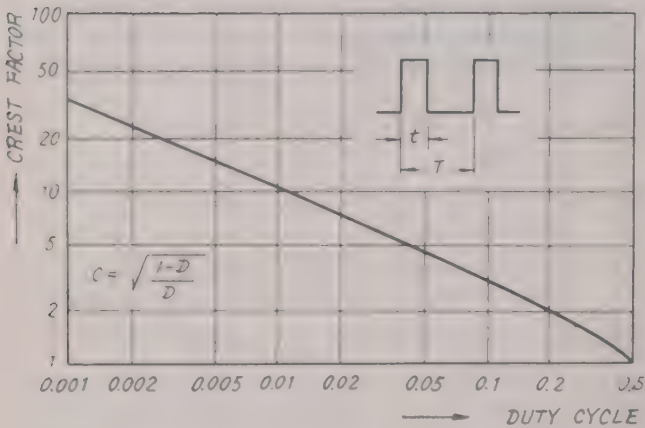


Fig. 2-14 Duty Cycle vs. Crest Factor

2. When T = 20 ms as is the case here, the relationship between crest factor and pulse width in ms is as given in Table 2-18.

Table 2-18 Pulse Width vs. Crest Factor

Pulse Width (ms)	10	4	2	1.18	0.77	0.54	0.4	0.31	0.24	0.20
Crest Factor	1	2	3	4	5	6	7	8	9	10

F. Adjustment of MULTIPLIER Ass'y: AS B9253HS

It is preferable to adjust this assembly at a temperature near that for an actual instrumentation. Therefore, use the cable previously employed for test.

a) Check of clock cycle

Procedure

1. Remove the DUAL RMS CONVERTER Ass'y, engage the MULTIPLIER Ass'y with J107, and allow an approximately 20-minute warmup.
2. Connect the oscilloscope between test points (TP7) and (S.G.). Confirm that the observed clock waveform is free from excessive chattering or ringing, and 10 to 11 μs in cycle time.

b) Balancing

Procedure

1. On the intermediate terminal board, connect (9) and (10) together, connect the Type 2552 between (21) and (10), and set it to 1.500000 V. Then connect the Type 2501 between (TP6) (Wout) and (S.G.) on the PCB Ass'y to be ready for measuring a dc voltage.
2. Adjust R29 (X-BAL) so that difference in readings of the Type 2501 will be within 0.5 mV when inverting the polarity of the applied voltage.
3. Open (9) and (10), and short (21) and (10), and connect the Type 2552 between (9) and (10). Adjust R58 (Y-BAL) so that difference in readings of the Type 2501 will be within 0.5 mV when inverting the polarity of the applied voltage.
4. Connect (9), (10) and (21) together, and adjust R59 (ZERO) so that the Type 2501 will indicate 0 V ± 0.5 mV.

(at T = 20 ms)

c) Full-scale calibration

Procedure

1. Short-circuit (9) and (21) on the intermediate terminal board, and apply 1.00000 V ac to (9) – (21) and (10) by the Type 2552. Adjust R50 [F.S. CORS] and R51 [F.S. FINE] so that the Type 2501 connected between test points (TP6) and (S.G.) will read 5.0000 V ± 0.5 mV.
2. Invert the polarity of the applied voltage, and confirm that the reading on the Type 2501 is 5.0000 V ± 3 mV. If it is not satisfied, repeat the procedure in b) Balancing stated above.

d) Phase adjustment

Procedure

1. Connect sine-wave outputs of the REFERENCE PHASE and VARIABLE PHASE sides of the Model 203A between (9) and (10), and (21) and (10) on the intermediate check terminal board respectively. Adjust both sine-wave outputs to 400 Hz and 1 V rms.
2. Finely adjust the VARIABLE PHASE dial near 90° so that reading on the Type 2501 will be minimum. Let us call that reading Z1.
3. Exchange inputs to (9) and (21), and let the reading on the Type 2501 at this time be Z2. Adjust C19 [PHASE] so that difference between Z1 and Z2 will be within 1.8 mV. When adjustment cannot be made by C19 only, increase or decrease C5 or C6. For the specified accuracy, refer to Table 2-19.
4. Change the frequency to 50/60 Hz, and repeat above steps 2 and 3. Confirm that difference between Z1 and Z2 is within 1.8 mV.

e) Frequency characteristics test

Procedure

1. Short (9) and (21) on the intermediate terminal board, and connect the Model 745A between (9) – (21) and (10). Set the Model 745A to 1.000000 V, vary the frequency to 40, 400 Hz and 1.2 kHz successively, and confirm that the frequency characteristics specified in Table 2-20 are satisfied.

Table 2-20 Frequency Characteristics Specifications

Frequency (Hz)	40	400	1.2k
2501 Reading (V)	5.0000 ±4.2mV	5.0000 ±4.2mV	5.0000 ±12.3mV
2504 Reading (normalized)	1.0000 ±8 digits	1.0000 ±8 digits	1.0000 ±25 digits

2. Then set the voltage to 0.500000 V and the frequency to 50/60 Hz on the Model 745A, and confirm that reading on the Type 2501 is 1.2500 V ± 0.88 mV.

f) Linearity test (dc)

Procedure

1. Prepare two Type 2552's, and connect them between (9) and (10), and between (21) and (10). Fix the output voltage of one side to 1000.000 mV, and vary the output of the other side to 0, 200.000 mV, 400.000 mV, ... and 1000.000 mV in 200-mV steps. Check the linearity of dc of this assembly measured by the Type 2501 against the linearity specifications given in Table 2-21.
2. Invert the polarity of both Type 2552's, and repeat the linearity test referring to step 1 above.
3. Change the fixed-voltage side, invert the polarity on one side, and repeat the linearity test referring to above steps 1 and 2. (When the polarity is different between both sides, the output polarity becomes negative.

Table 2-19 Power-Factor Characteristics Specifications

Frequency (Hz)	50 60	400
2501 Reading (V)	0.00000 ±1.8mV	0.00000 ±1.8mV
2504 Reading (normalized)	0.0000 ±4 digits	0.0000 ±4 digits

Table 2-21 Linearity Specifications (dc)

2552 Setting (mV)	0.00000	200.000	400.000	600.000	800.000	1000.000
2501 Reading (V)	0.00000 ±0.7mV	1.00000 ±1.4mV	2.0000 ±2.1mV	3.0000 ±2.8mV	4.0000 ±3.5mV	5.0000 ±4.2mV
2504 Reading (normalized)	0.0000 ±1 digit	0.2000 ±3 digits	0.4000 ±4 digits	0.6000 ±6 digits	0.8000 ±7 digits	1.0000 ±8 digits
Accuracy	± (0.1% of rdg + 0.02% of f.s.) × 0.7					

* One input is fixed at 1000.000 mV, and the other input is varied from 0 to 1 V in 200-mV steps.

g) Linearity test (ac)

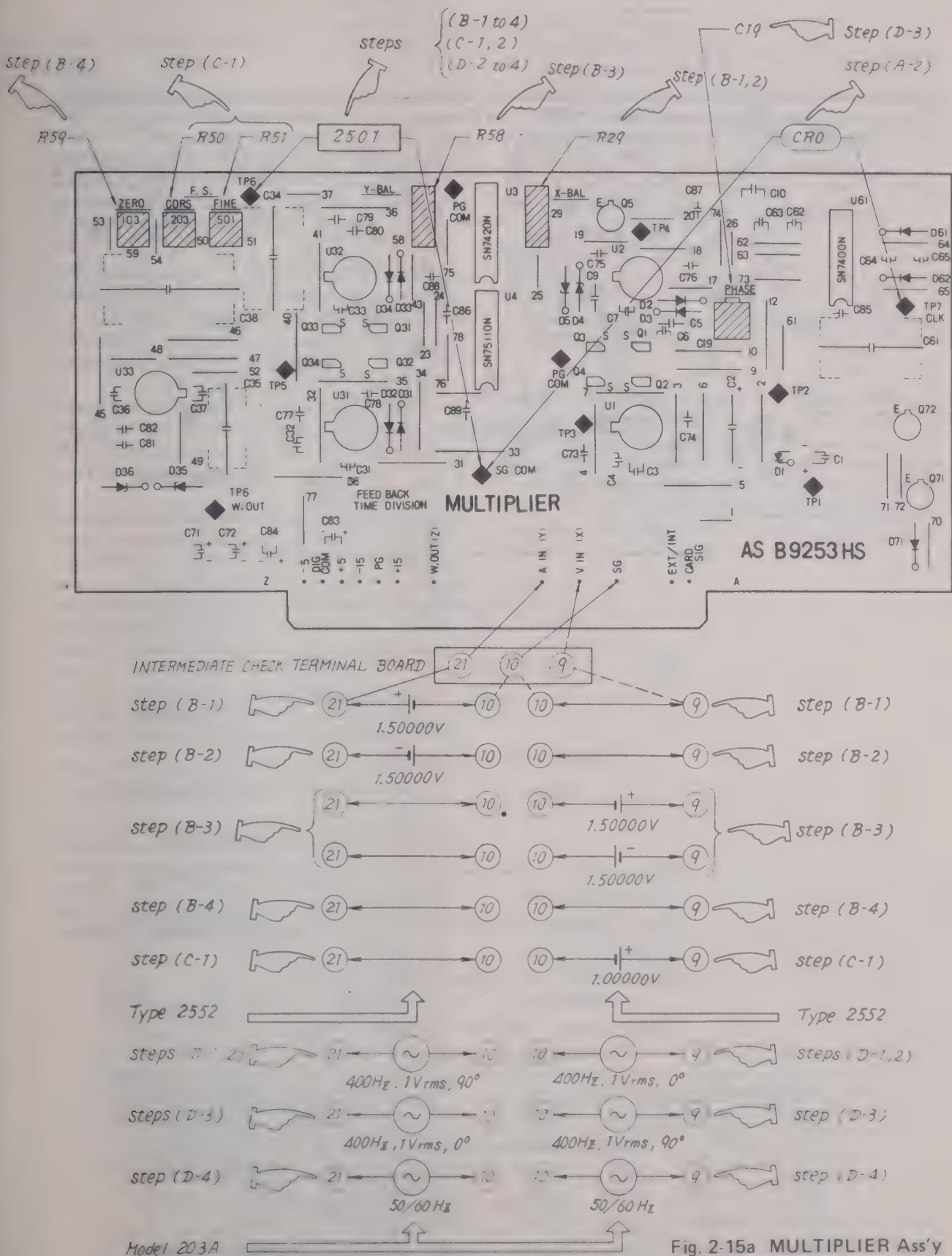
Procedure

1. Short-circuit (9) and (21) on the intermediate terminal board, and connect the Model 745A between (9) – (21) and (10). Set the frequency to 50/60 Hz, and vary the output voltage of the Model 745A to 0, 0.250000, 0.500000, 0.750000 and 1.000000 in 0.25-V steps. Check the linearity of ac measured by the Type 2501 against the linearity specifications given in Table 2-22.

For locations, settings and connections of the above test points, adjust rheostats and instruments, see Figs. 2-15a and b.

Table 2-22 Linearity Specifications (ac)

745A Setting (V)	0.000000	0.250000	0.500000	0.750000	1.000000
2501 Reading (V)	0.00000 ±0.7mV	0.31250 ±0.9mV	1.25000 ±1.6mV	2.8125 ±2.8mV	5.0000 ±4.2mV
2504 Reading (normalized)	0.0000 ±1 digit	0.0625 ±2 digits	0.2500 ±3 digits	0.5625 ±5 digits	1.0000 ±8 digits
Accuracy	± (0.1% of rdg + 0.02% of f.s.) × 0.7				



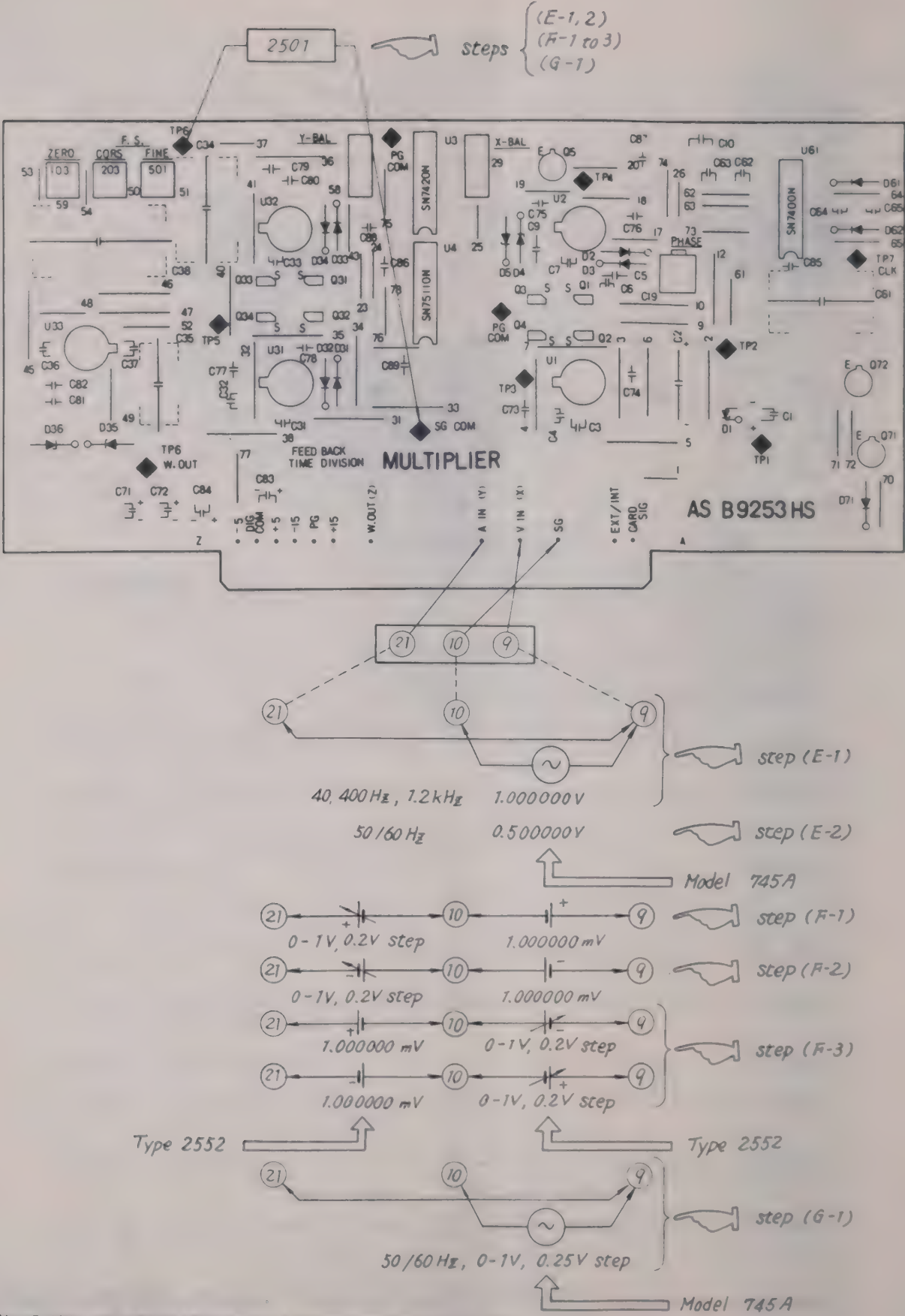


Fig. 2-15b MULTIPLIER Ass'y Adjustment Procedure (2)

G. INPUT MODULE adjustment

Procedure

1. Interconnect the Type 2504 mainframe equipped with the five assemblies adjusted as above (POWER SUPPLY, DISPLAY, A/D CONVERTER, DUAL RMS CONVERTER and MULTIPLIER) in place and the INPUT MODULE by means of the connecting cable for test illustrated in Fig. 2-10, and allow the instrument an approximately 20-minute warmup.
2. Adjust zero by R8 **V-ADJ** on the PCB Ass'y: AS B9254BK mounted on the Type 2514 so that reading on the Type 2501 connected between intermediate check terminals (9) and (10) of the cable for test, or between Vin and S.G., will be minimum.
3. In the same way, adjust zero by R9 **A-ADJ** so that reading on the Type 2501 connected between intermediate check terminals (21) and (10), or between Ain and S.G., will be minimum.
4. Connect the Model 745A to the voltage input terminal of the Type 2514, and apply an input of 100.0000 V and 50/60 Hz. At this time connect a resistor of an appropriate value (normally of 27 to 56 MΩ) onto the pattern side of the PCB across R1 so that the Type 2504 will indicate approximately 1.0004. This measure is taken to improve the drooping characteristic around 2 kHz.
- If such a resistor is mounted on Type 2514 brought to you for adjustment or servicing, don't take it off carelessly, because it has the abovementioned purpose.
- Then confirm by applying an input voltage of 100.0000 V and 2 kHz, that the specified accuracy is satisfied.
5. Using the power factor test set (Fig. 2-4), and referring to 2.4.2.E, apply rated voltage and current fixed for the particular INPUT MODULE (100 V, 1 A for Type 2514-06; 100 V, 2 A for Type 2514-07). Adjust C3 so that the wattage indication on the Type 2504 will be 0.0000 ± 14 digits (±0.14% of range) at cos φ = 0.

When the above accuracy is not satisfied by C3 only, increase or decrease C1 or C2.

Note that the indication will be normalized to 1.0000 at any rated input because the RANGING CARD Ass'y is not employed in this test.

For details of INPUT MODULES, refer to service manuals for the Type 2514-01, 02, 06 and 07.

H. Operation check of RANGING CARD Ass'y: AS B9253HE

After the INPUT MODULE has been adjusted as above, engage the RANGING CARD Ass'y with J104.

Rated voltages, rated currents and wattages covered by the four INPUT MODULES are as given in Table 2-23. Check the Type 2504 for ranging, and indication of the polarity, units and decimal points for each measurement functions by applying rated voltage and current corresponding to the voltage and current input terminals of the relevant INPUT MODULE using the wattage display test set illustrated in Fig. 2-3.

Table 2-23 Ranging

Rated Voltage Rated Current		Ranging					
		30 V	60 V	100 V	150 V	300 V	600 V
		30.00 V	60.00 V	100.00 V	150.0 V	300.0 V	600.0 V
0.5A	500.0mA	15.00W	30.00W	50.00W	75.00W	150.0W	
1 A	1000.0mA	30.00W	60.00W	100.00W	150.0W	300.0W	
2 A	2.000A	60.00W	120.0W	200.0W	300.0W	600.0W	1.200kW
5 A	5.000A	150.0W	300.0W	500.0W	750.0W	1.500kW	3.000kW
10 A	10.000A	300.0W	600.0W	1000.0W	1.500kW	3.000kW	6.000kW
20 A	20.00A			2.000kW	3.000kW	6.000kW	12.00kW

I. Operation check of BCD OUTPUT CARD Ass'y: AS B9253YH (option)

When this assembly is optionally provided, it is necessary to check function and measurement range selection and HOLD and START actuation by an external control as well as BCD outputs, and unit and point outputs. (See Tables 1-9 and 1-10)

BCD, unit and point outputs can be checked by recording on a typewriter or a digital printer wired to the

BCD OUTPUT connector of the Type 2504. If a printer or the like is not available, it would involve a troublesome operation of checking the BCD OUTPUT connector pins one by one for a signal level.

It would also be necessary to use an external network as illustrated in Fig. 2-16 for checking external control action of the measurement functions and ranges.

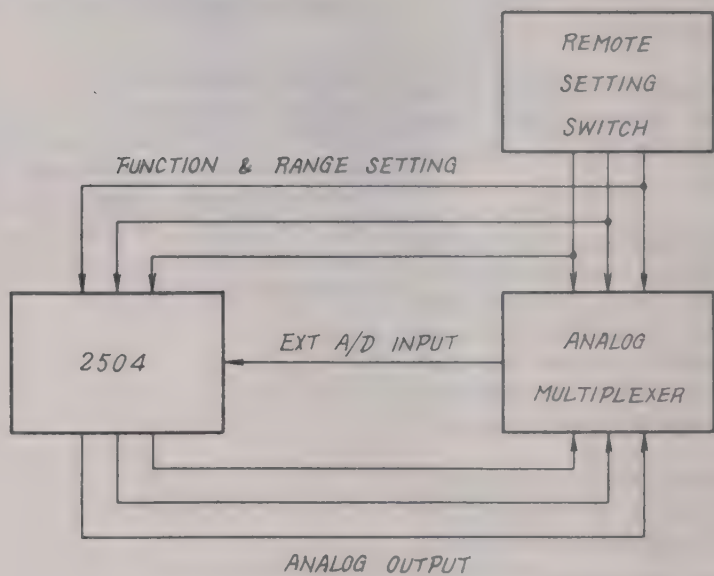


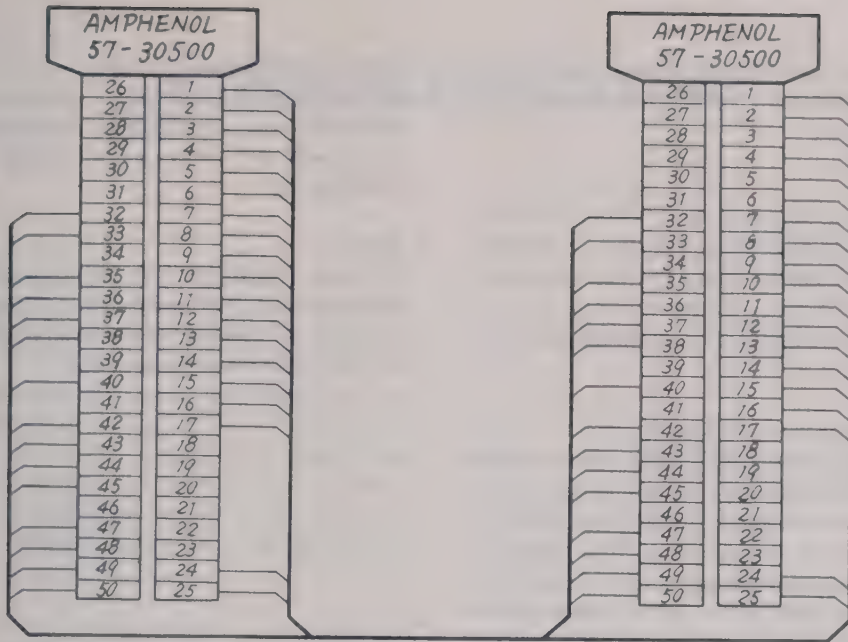
Fig. 2-16 Way of Remote Setting

Figs. 2-17a and b show an external view and a circuit diagram respectively of a BCD OUTPUT test set for easily checking the BCD output and external control actions. The test set shown is only an example. It is recommended to build a more practical test set yourselves based on the example.

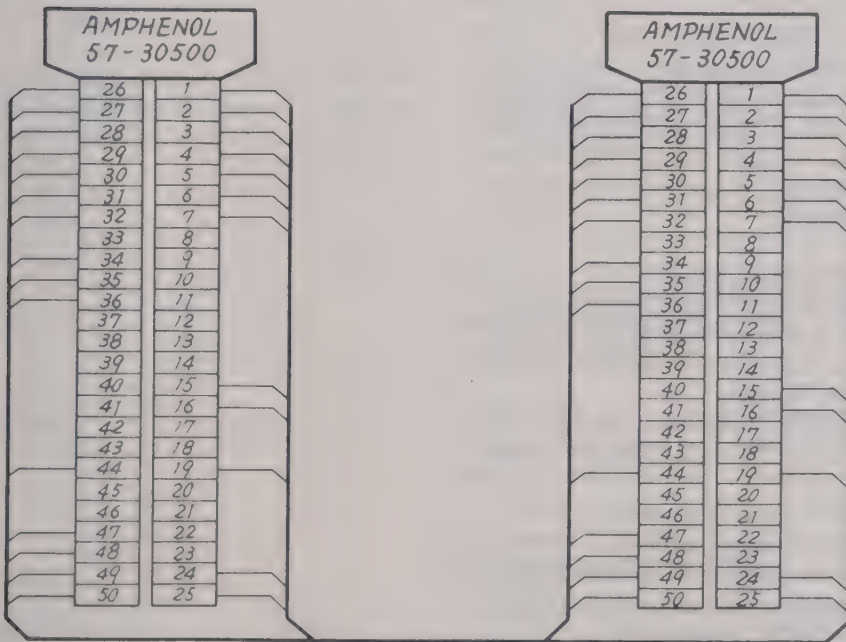
The test set is so designed that it will be usable for testing low-current ranges (1 mA, 2 mA, ... and 0.1 A), wattages (3 ϕ 3-wire, 3 ϕ 4-wire) and reactive power (Var), which measurement functions will possibly be added on the Type 2504 later. If existing functions only are envisaged, functions superfluous at the present stage may be omitted.



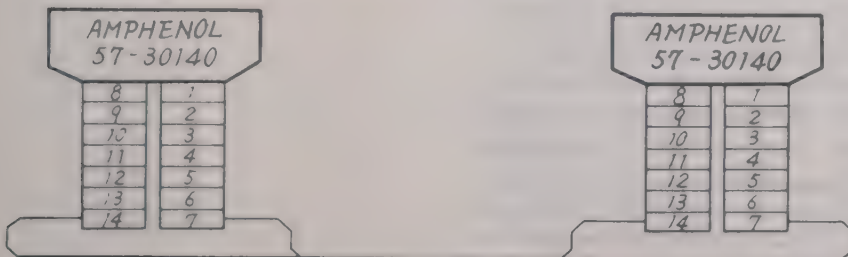
Fig. 2-17a External View of BCD OUTPUT CARD Ass'y Test Set



a) Cable for BCD OUTPUT



b) Cable for CONTROL INPUT



c) Cable for ANALOG OUTPUT

Connect pins of same nos.
Cable length: approx 1 m

Fig. 2-18 Cables for Test Set

The following discussion concerns check procedures of the BCD OUTPUT CARD Ass'y using the test set. (INPUT MODULE is unnecessary.)

a) Preparation

Interconnect the test set, BCD OUTPUT, CONTROL INPUT and ANALOG OUTPUT connectors on the rear panel of the Type 2504 by means of three connecting cables which should be prepared on your side as depicted in Fig. 2-18. Switch on the test set and Type 2504.

b) Check of EXT. HOLD and EXT. START

Depress pushbutton switch **EXT. HOLD** (lock) on the test set, and confirm that measurement is made only while pushbutton switch **EXT. START** (non-lock) is depressed. Note that the display on the Type 2504 and test set doesn't necessarily correspond to the rated input exactly because the EXT. A/D INPUT voltage is not adjusted yet (5 V ADJ on test set), and that the function and range are those set by each switch.

c) Check of EXT. FUNCTION selecting action

Remove the EXT. HOLD condition of the test set. After depressing pushbutton switch **EXT. FUNCTION** (lock), successively depress **V**, **A** and **W** (lock-release) to check the function selecting action of the BCD OUTPUT CARD Ass'y through unit indication on the Type 2504 and test set.

d) Check of EXT. RANGE selecting action

1) With above switches **EXT. FUNCTION** and **V** kept depressed, depress switch **EXT. RANGE** (lock). Display at this time corresponds to a range already set by EXT. RANGE.

2) Then depress **10 V**, and adjust the EXT. A/D INPUT voltage so that the Type 2504 will indicate 10.000 V.

3) Confirm that the voltage range selecting action is normal by indications 30.00 V, 60.00 V, 100.00 V, 150.0 V, 300.0 V and 600.0 V on the Type 2504 and test set when depressing pushbutton switches **30 V**, **60 V**, ... and **600 V** successively.

4) Confirm that pushbutton **UP PUSH** (lock) is set to UP. (If it is not at UP, check cannot be made because low-current range which is not under test is selected.)

Depress switch **A**, and then, **0.5 A**, **1 A**, ... and **20 A** successively. Confirm that the Type 2504 and test set indicate 0.5000 A, 1.0000 A, and 20.00 A.

5) Depress pushbutton **W**, and then a voltage-range button and a current-range button simultaneously. When the **600 V** button and **20 A** button are depressed, for example, the Type 2504 and test set should indicate 12.00 kW.

e) Check of OVER range display

By throwing the EXT. INPUT switch on the test set to the OVER side, the **OVER** display lamp on the test set as well as 0.0000 on the test set and Type 2504 should wink.

f) Others

By using a BCD OUTPUT CARD Ass'y whose normal operation has been confirmed, the RANGING CARD Ass'y can be checked for operation on all ranges of V, A and W in the manner stated above.

3, TROUBLESHOOTING

3.1 Description

If a trouble has occurred in the instrument, first judge whether the trouble is attributable to the instrument itself or external devices. If the trouble has been judged attributable to the instrument, the faulty point should be located, repaired, and adjusted to satisfy the test standards. For such purpose measuring instruments and tools as given in 2.4.1 and 2.5.2.A are required.

Unless the abovementioned instruments and tools, and skilled electrical engineers well versed in the circuits are available, refrain from repairing the instrument at your side. This also applies to YEW agents.

If the instrument is tampered with by insufficient measuring facilities and/or unskilled engineers, YEW will not be responsible for troubles or malfunctions caused by such improper intervention.

3.2 Troubleshooting Procedure

On this instrument which consists of several PCB assemblies each having different functions, an orthodox method of theoretically tracing a troubled point according to the symptom appearing externally may consume much time before locating a very simple affected part.

To find out in a short time which part of the instrument or which assembly the trouble lies in, use a complete set of the same assemblies which work normally. If the trouble disappears by replacing assemblies on the instrument under test one by one with the latter ones, the circuit corresponding to the latter assembly is judged to be faulty. If the trouble has not stopped even by replacing all the assemblies, the trouble must be outside the PCB assemblies, that is, in either the INPUT MODULE or the basic circuit of the Type 2504.

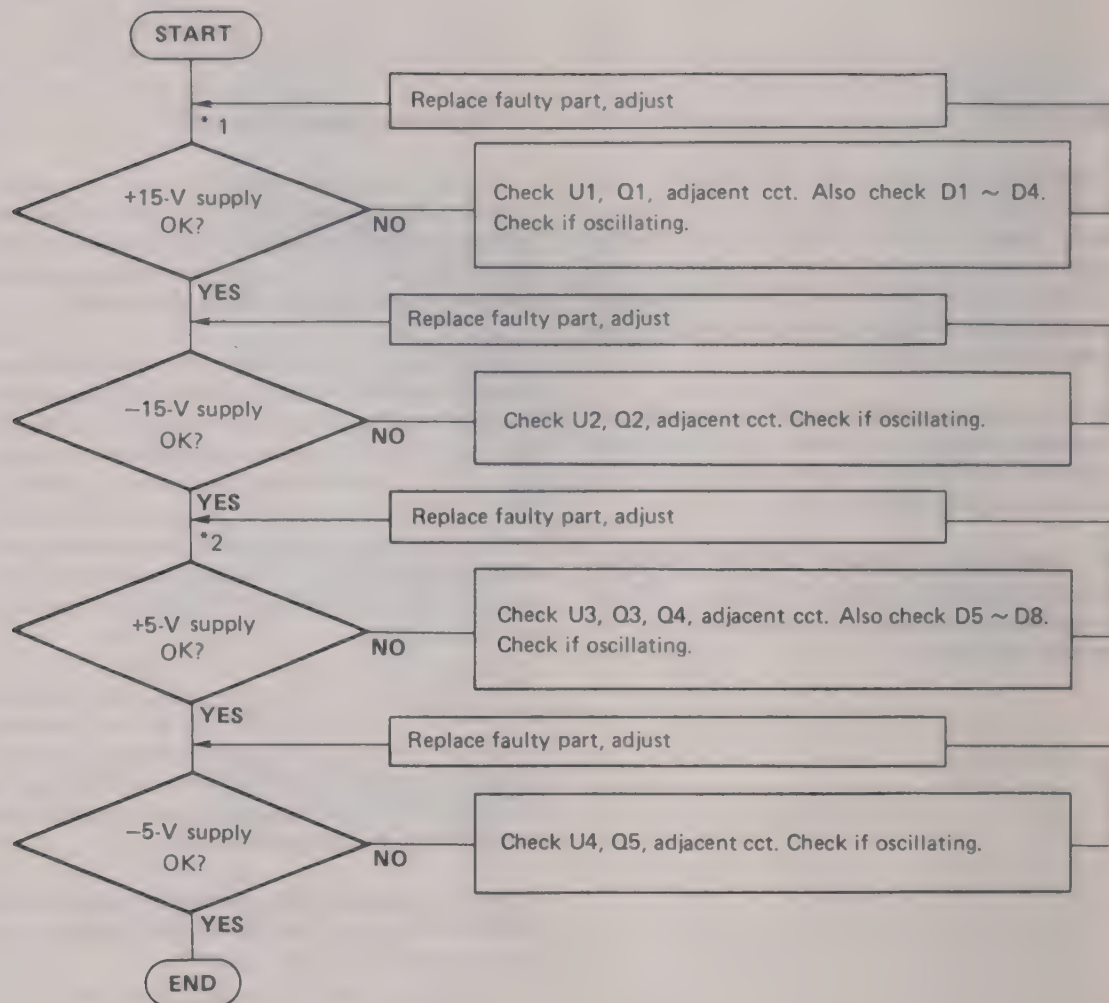
Thus gradually restrict areas which might be troubled. As soon as it is known in which part of assembly the trouble lies, locate the affected point or faulty part by the procedure stated in the section on the INPUT MODULE adjustment and the flow charts given below, and then proceed to repair, adjustment and test.

Use of normally working assemblies not only facilitates troubleshooting, but also enables to know the normal operating condition of each assembly.

3.3 Contents of Flow Chart

Par.	Description	Fig. No.	Page
1.	POWER SUPPLY Ass'y	3-1	3-2
2.	DISPLAY Ass'y	3-2	3-3
3.	A/D CONVERTER Ass'y	3-3	3-6
4.	DUAL RMS CONVERTER	3-4	3-7
5.	MULTIPLIER Ass'y	3-5	3-10
6.	INPUT MODULE Ass'y	3-6	3-11
7.	RANGING CARD Ass'y	3-7	3-12
8.	BCD OUTPUT CARD Ass'y	3-8	3-14

3.3 Flow Chart



*1: If the -15-V power supply is faulty (typically dead shorting of the -15-V power supply output) when checking the +15-V power supply, output of the +15-V power supply will rise by approximately +1%.

*2: If the -5-V power supply is faulty (same condition as above) when checking the +5-V power supply, output of the +5-V power supply will rise by approximately +0.5%.

Fig. 3-1

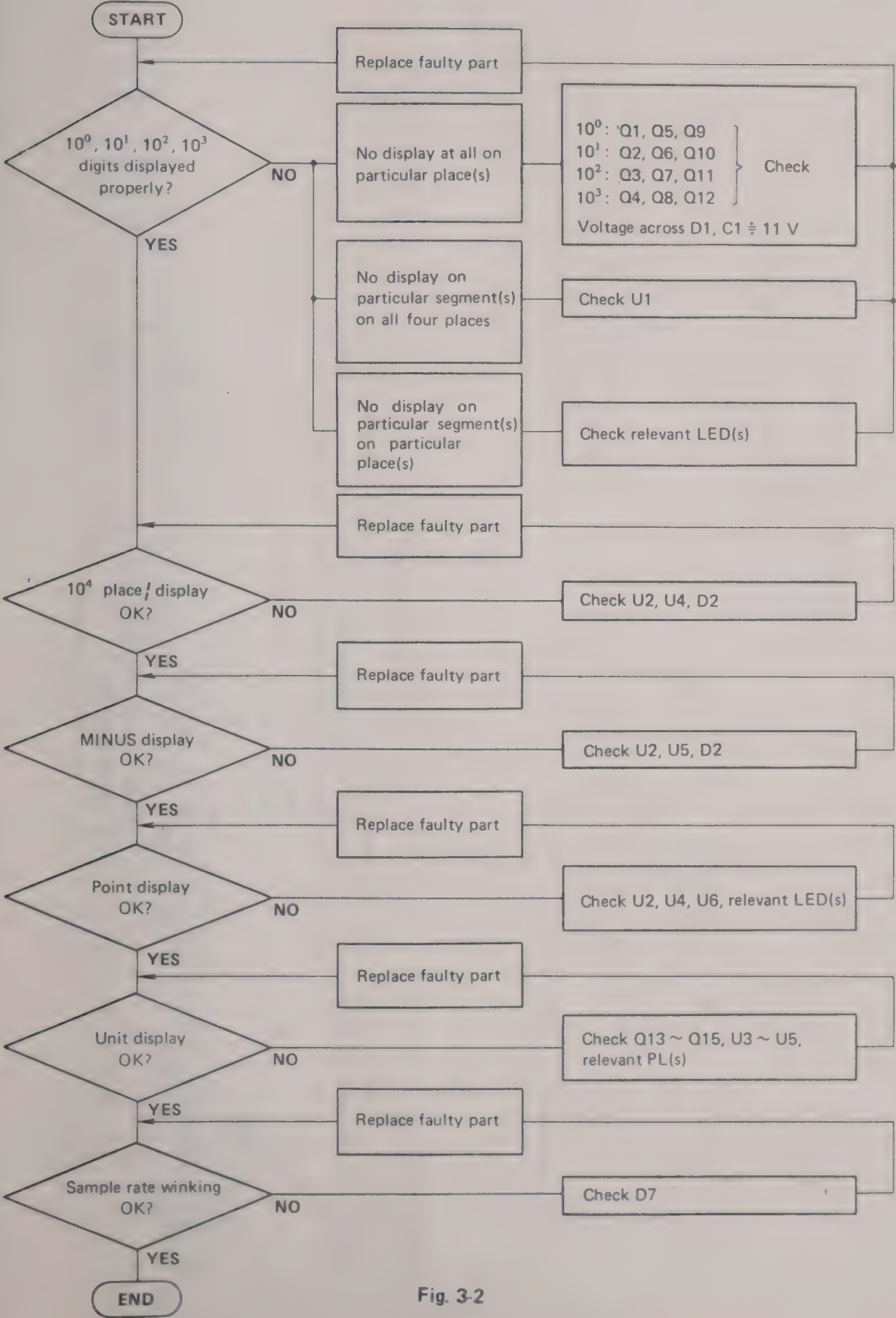
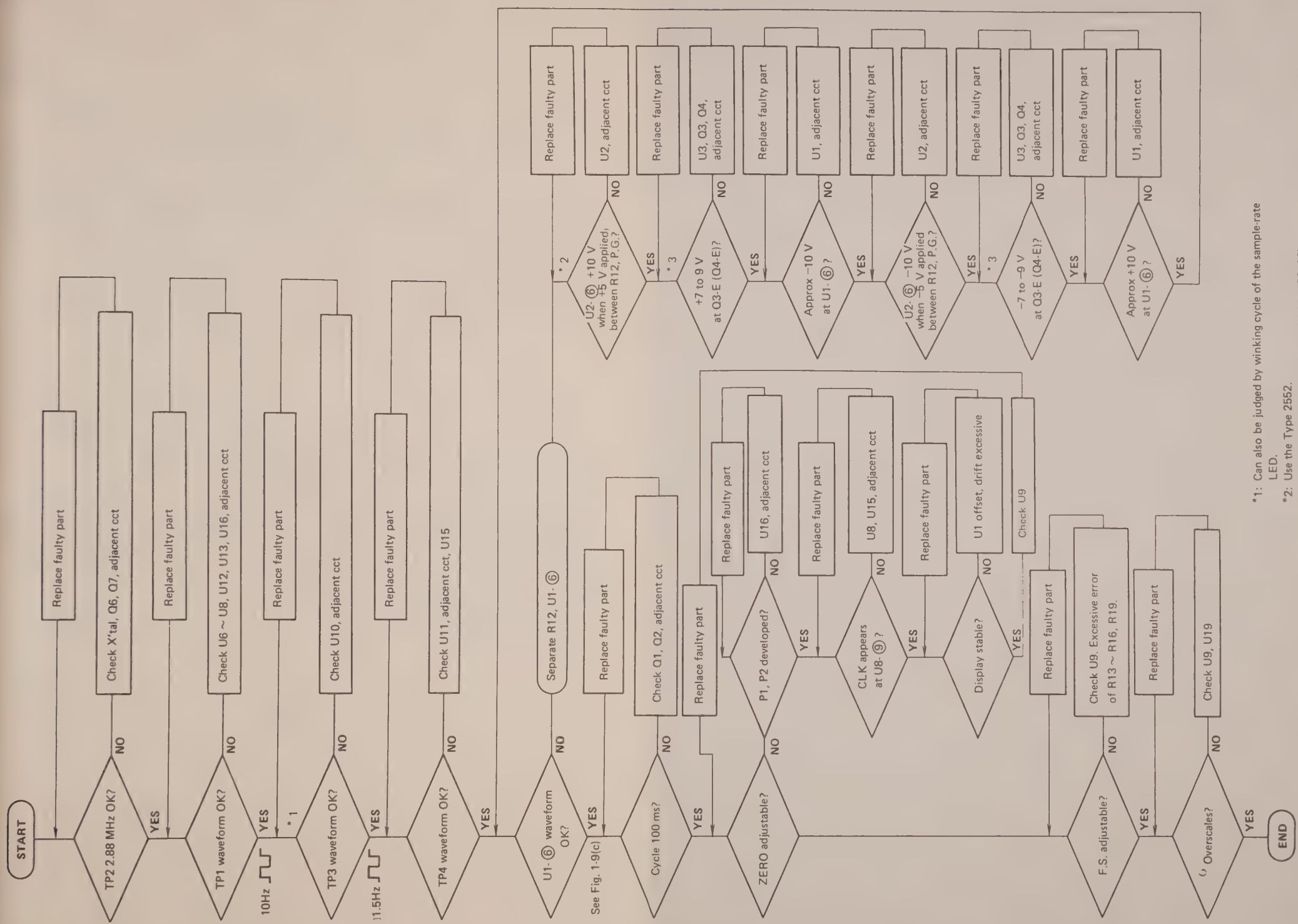


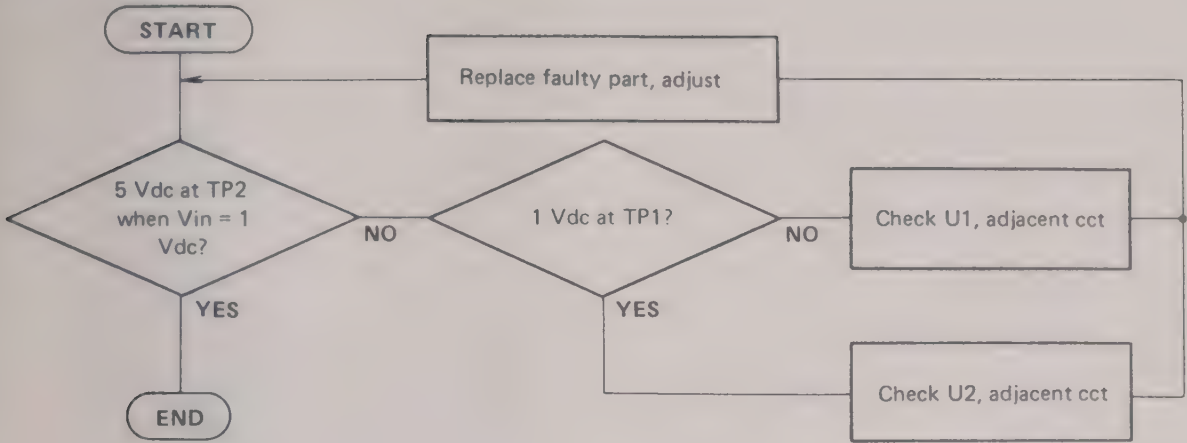
Fig. 3-2



*1: Can also be judged by winking cycle of the sample-rate LED.
*2: Use the Type 2552.
*3: Determined by zener voltage of D10 (1S2192).

Fig. 3-3

VOLTAGE SIDE



CURRENT SIDE

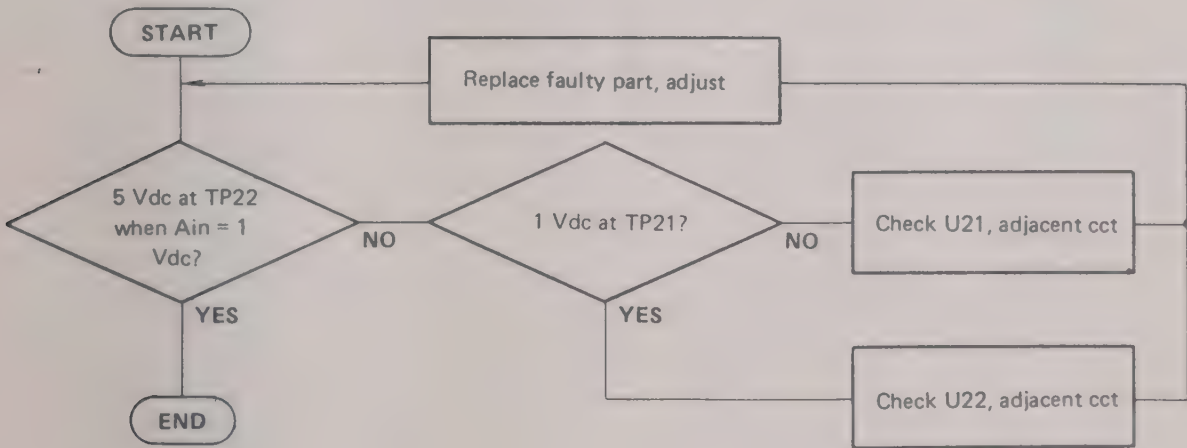


Fig. 3-4

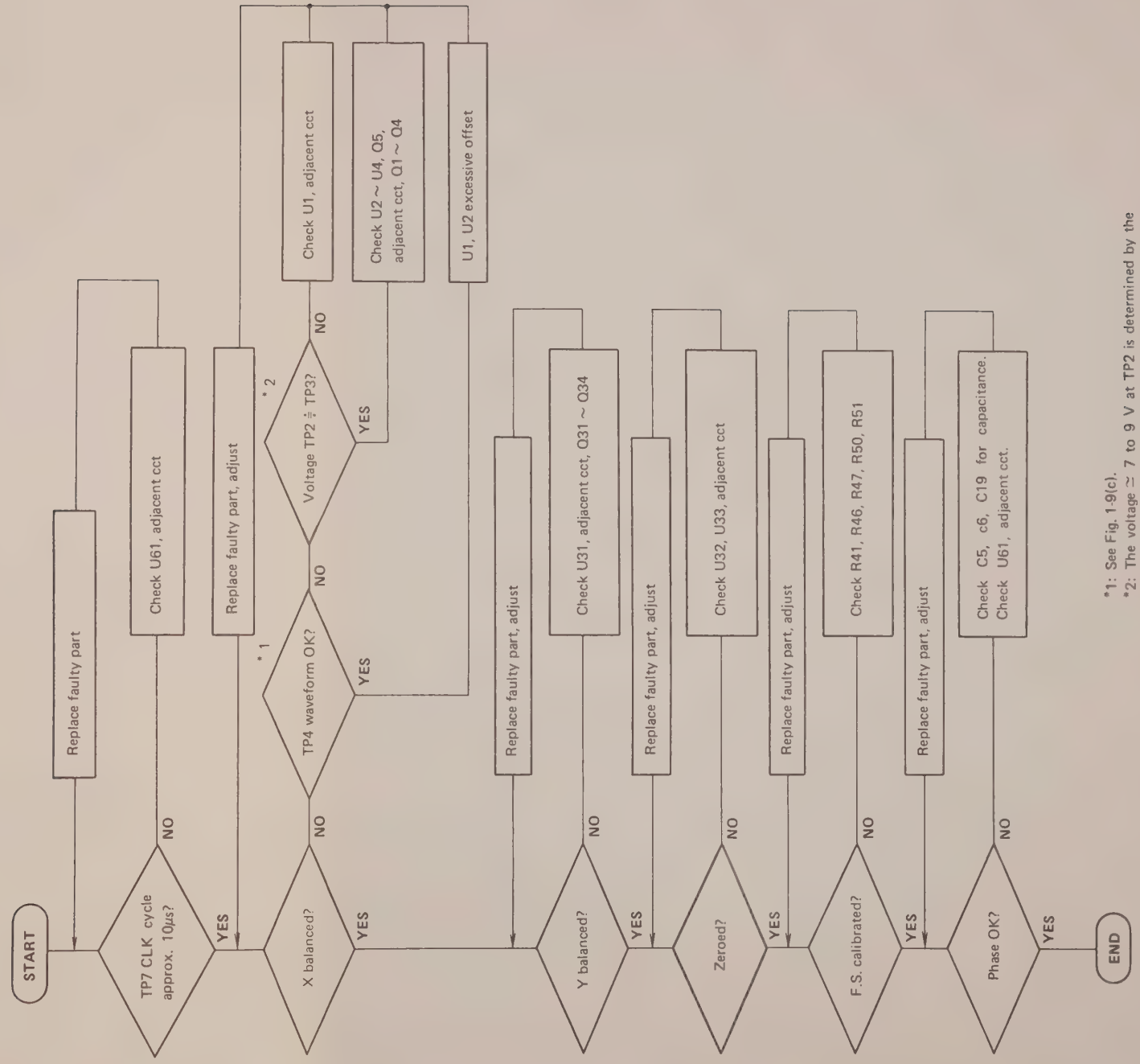
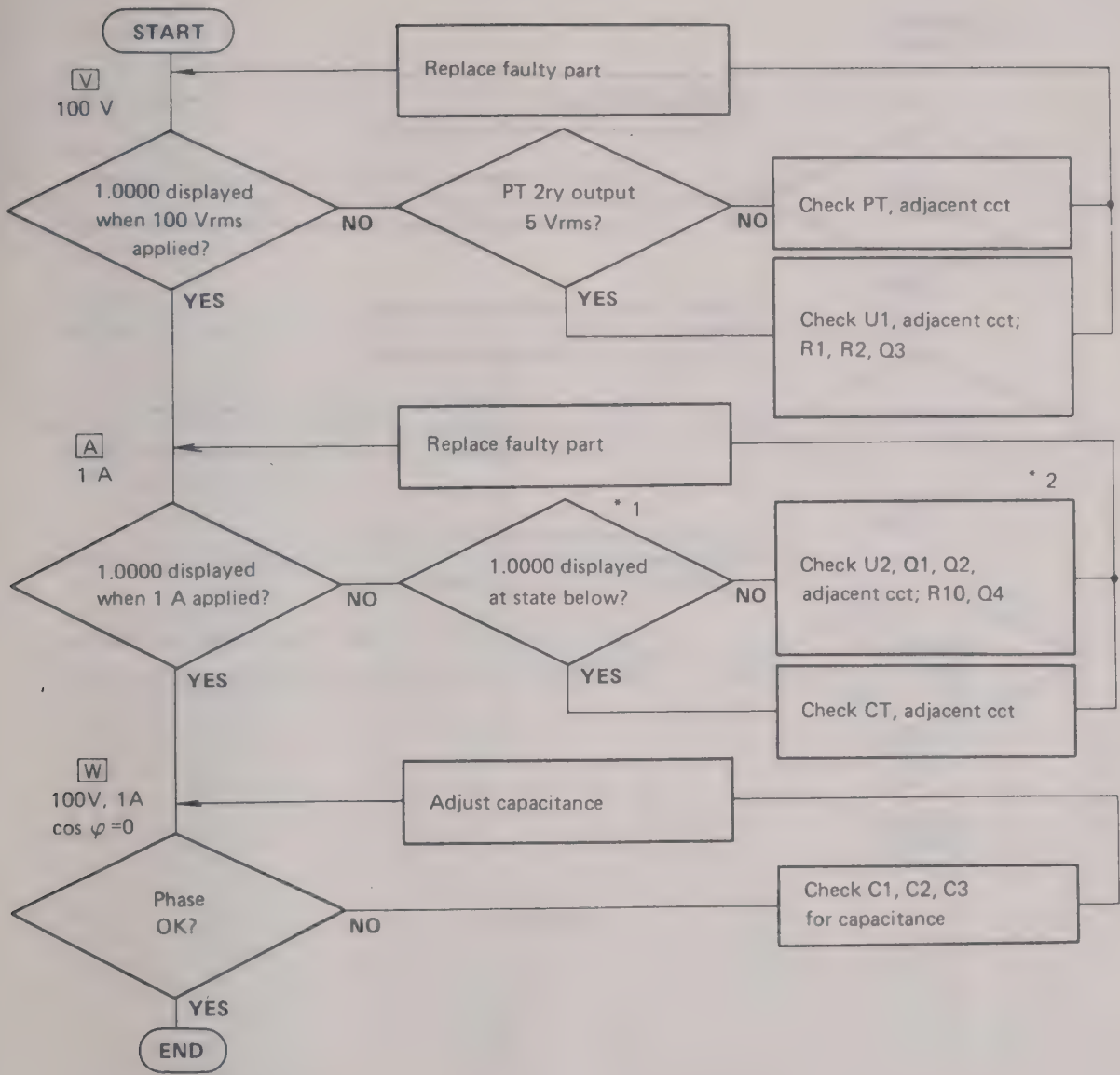


Fig. 3-5



*1: Remove the rated input, disconnect a CT secondary conductor at the connector, and connect the Type 2853 or an equivalent between the said conductor and connector pin to apply 10.00 mA.

*2: When an optional INPUT MODULE has a current range of mA, check Q5 additionally.

Fig. 3-6

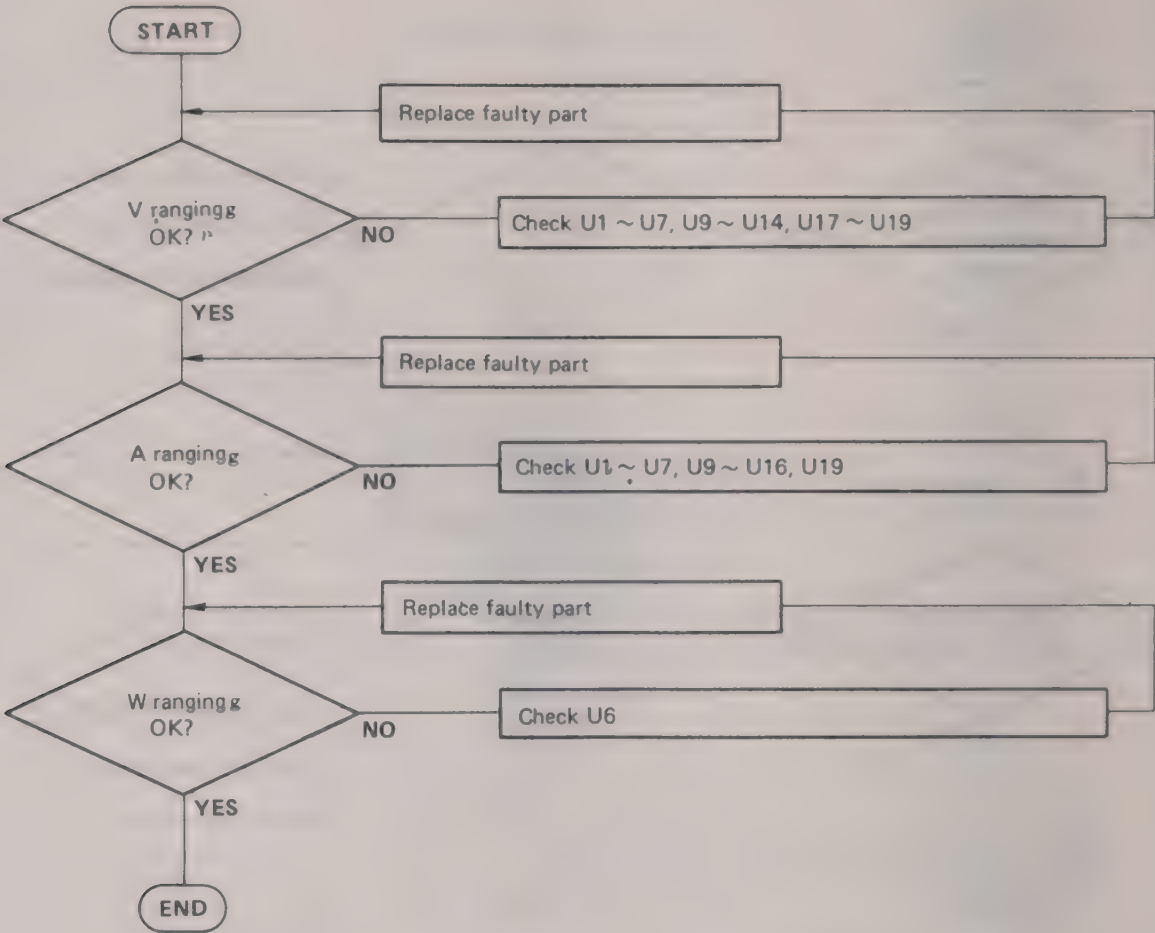
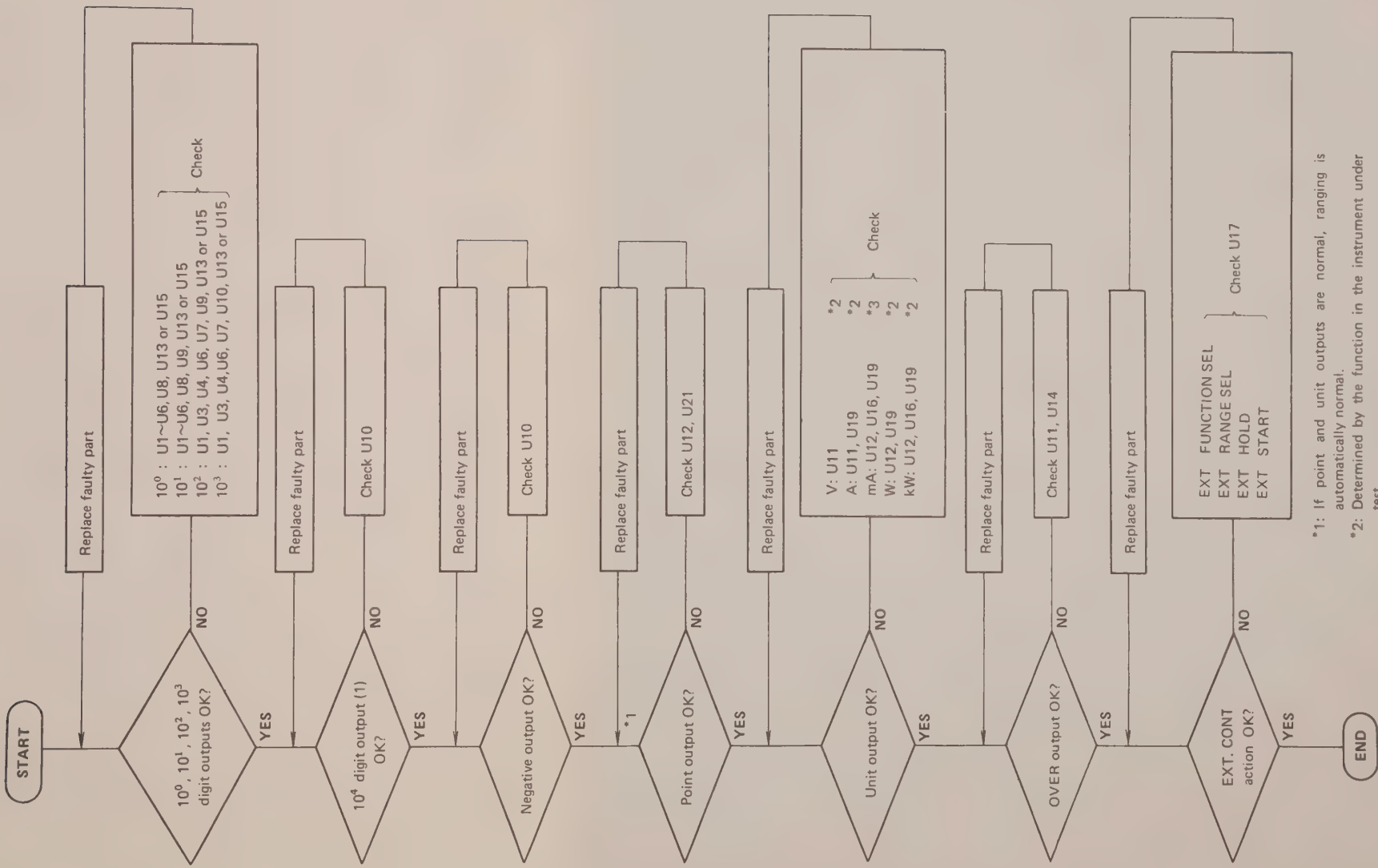


Fig. 3-7



*1: If point and unit outputs are normal, ranging is automatically normal.
*2: Determined by the function in the instrument under test.
*3: Refers only to a special version having a current measurement range of mA.

Fig. 3-8

3.4 Transistors and ICs Employed

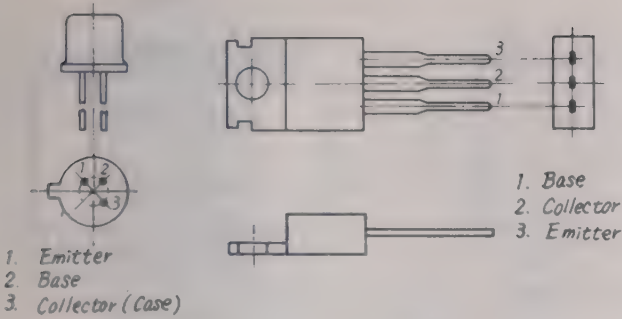
Main functions of transistors and ICs employed on the Type 2504 are given in Table 3-1. Their pin connections are illustrated in Figs. 3-9-1 through 3-9-34.

Table 3-1

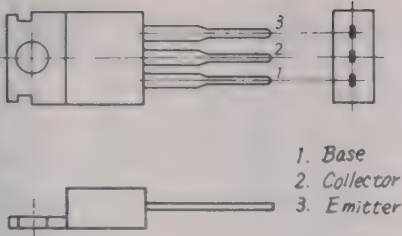
AS	Type	Description	Fig. No.
POWER SUPPLY	2SA603	PNP Epitaxial Silicon Transistor	3-9-1
	2SA671	PNP Triple Diffused Silicon Transistor	3-9-2
	2SB504	PNP Epitaxial Planar Silicon Transistor	3-9-3
	2SC1060	NPN Triple Diffused Silicon Transistor	3-9-4
	μPC141A	Precision Positive Voltage Regulator	3-9-6
	μPC142A	Precision Negative Voltage Regulator	3-9-7
DISPLAY	2SA603	PNP Epitaxial Silicon Transistor	3-9-1
	2SC97A	NPN Epitaxial Silicon Transistor	3-9-3
	2SC943	NPN Epitaxial Silicon Transistor	3-9-1
	HD2503P	Quad. 2-Input Positive NAND Gates	3-9-9
	HD2511P	Quad. 2-Input Positive NOR Gates	3-9-10
	HD2522P	Hex Inverters	3-9-11
	HD2532P	BCD-to-Seven Segment Decoders/Drivers	3-9-16
	SN7406N	Hex Inverters Buffers/Drivers (with Open Collector)	3-9-11
	SN7407N	Hex Buffers/Drivers (with Open Collector)	3-9-12
	TLR303	GaP Hybrid Light-Emitting Diode Array	3-9-33
	TLR304	GaP Hybrid Light-Emitting Diode Array	3-9-34
A/D CONVERTER	2SA603	PNP Epitaxial Silicon Transistor	3-9-1
	2SC943	NPN Epitaxial Silicon Transistor	3-9-1
	2SC1216	NPN Epitaxial Silicon Transistor	3-9-1
	CD4012AE	COS/MOS NAND Gates (Positive Logic)	3-9-25
	CD4020AE	COS/MOS 14-Stage Ripple-Carry Binary Counter/Driver	3-9-27
	CD4050AE	COS/MOS Hex Buffer/Converters	3-9-28
	DM74L04N	Hex Inverters	3-9-11
	HD2503P	Quad. 2-Input Positive NAND Gates	3-9-9
	HD2510P	Dual D-Type Edge-Triggered Flip-Flops	3-9-18
	HD2511P	Quad. 2-Input Positive NOR Gates	3-9-10
	HD2515P	Dual J-K Master-Slave Flip-Flops	3-9-17
	HD2521P	Divide-by-Twelve Counters	3-9-20
	HD2543P	Monostable Multivibrators	3-9-23
	LM555CN	Timer	3-9-29
	μPC157A(1)	General-Purpose Operational Amplifier	3-9-8
DUAL RMS	μPD851D	CMOS 4.5 Digit Counter	3-9-30
	2SC943	NPN Epitaxial Silicon Transistor	3-9-1
	6005	True RMS-to-DC Converter	3-9-31
	μPC157A(1)	General-Purpose Operational Amplifier	3-9-8

Table 3-1 (Continued)

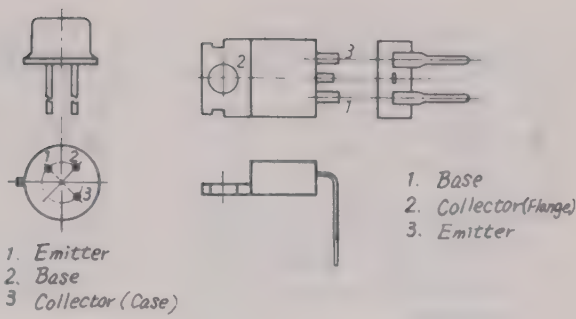
AS	Type	Description	Fig. No.
MULTI- PLIER	2SC943	NPN Epitaxial Silicon Transistor	3-9-1
	2SC1216	NPN Epitaxial Silicon Transistor	3-9-1
	2SK23A	N-channel Silicon Junction FET	3-9-5
	SN7400N	Quad. 2-Input Positive NAND Gates	3-9-9
	SN7420N	Dual 4-Input Positive NAND Gates	3-9-15
	SN75110N	Dual Line Drivers	3-9-22
	μ PC157A(1)	General-Purpose Operational Amplifier	3-9-8
INPUT MODULE	2SA603	PNP Epitaxial Silicon Transistor	3-9-1
	2SC943	NPN Epitaxial Silicon Transistor	3-9-1
	μ PC157A(1)	General-Purpose Operational Amplifier	3-9-8
RANGING CARD	2SB504	PNP Epitaxial Planar Silicon Transistor	3-9-3
	2504	2048 Bit Mask Programmable ROM	3-9-32
	SN7400N	Quad. 2-Input Positive NAND Gates	3-9-9
	SN7405N	Hex Inverters (with Open Collector)	3-9-11
	SN74151N	Data Selectors/Multiplexers	3-9-24
	SN74LS00N	Quad. 2-Input Positive NAND Gates	3-9-9
	SN74LS04N	Hex Inverter	3-9-11
	SN74LS10N	Triple 3-Input Positive NAND Gates	3-9-14
	SN74LS20N	Dual 4-Input Positive NAND Gates	3-9-15
	SN74LS73N	Dual J-K Master-Slave Flip-Flops	3-9-17
	SN74LS90N	Decade Counters	3-9-19
BCD OUTPUT CARD	2SC943	NPN Epitaxial Silicon Transistor	3-9-1
	CD4015AE	COS/MOS Dual 4-Stage Static Shift Register	3-9-26
	CD4050AE	COS/MOS Hex Buffer/Converters	3-9-28
	DM74L04N	Hex Inverter	3-9-11
	DM74L74N	Dual D-Type Edge-Triggered Flip-Flops	3-9-18
	DM74L93N	4-Bit Binary Counters	3-9-21
	HD2503P	Quad. 2-Input Positive NAND Gates	3-9-9
	HD2507P	Triple 3-Input Positive NAND Gates	3-9-14
	HD2511P	Quad. 2-Input Positive NOR Gates	3-9-10
	HD2522P	Hex Inverter	3-9-11
	HD2523P	Hex Inverter (with Open Collector)	3-9-11
	HD2551P	Quad. 2-Input Positive AND Gate (with Open Collector)	3-9-13
	SN7407N	Hex Buffer/Driver (with Open Collector)	3-9-12



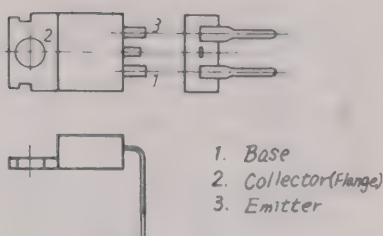
2SA603
2SC943
2SC1216
Fig. 3-9-1



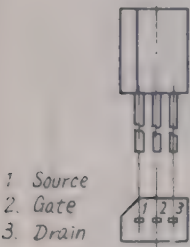
2SA671
Fig. 3-9-2



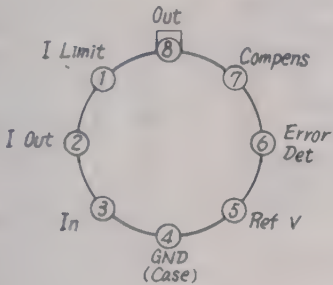
2SB504
2SC97A
Fig. 3-9-3



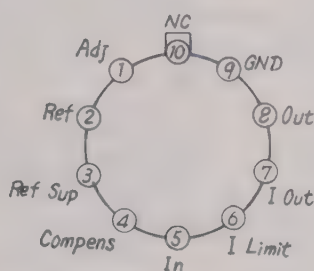
2SC1060
Fig. 3-9-4



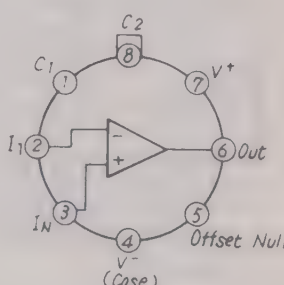
2SK23A
Fig. 3-9-5



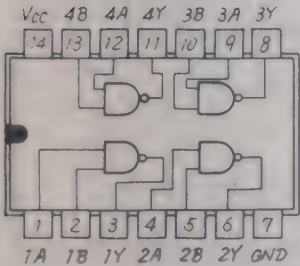
μPC141A
Fig. 3-9-6



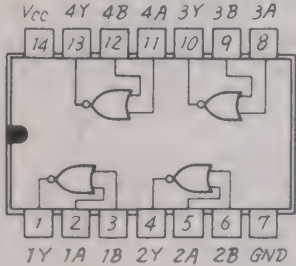
μPC142A
Fig. 3-9-7



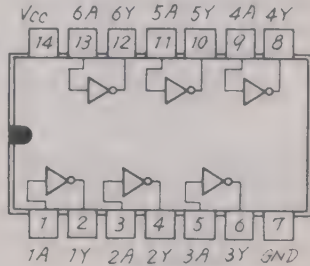
μPC157A
Fig. 3-9-8



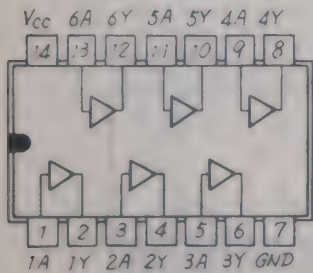
HD2503P, SN7400N
SN74LS00N
Fig. 3-9-9



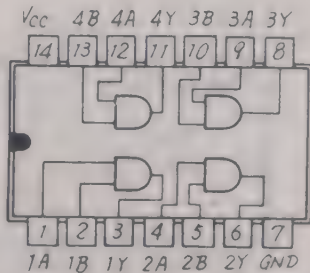
HD2511P
(SN7402N)
Fig. 3-9-10



DM74L04N, HD2552P
SN74LS04N, (SN7404N)
HD2523P, SN7405N
SN7406N
Fig. 3-9-11



SN7407N
Fig. 3-9-12



HD2551P, (SN7409N)
Fig. 3-9-13

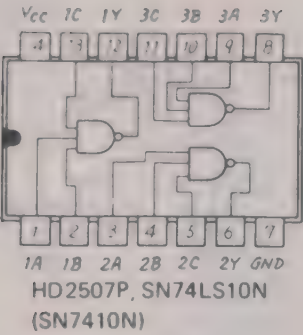


Fig. 3-9-14

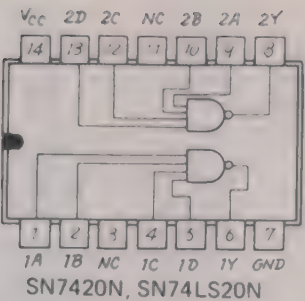


Fig. 3-9-15

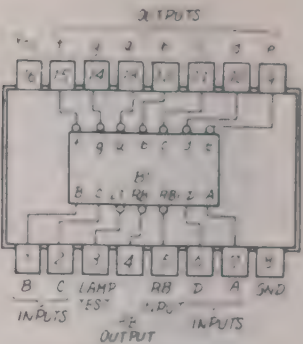


Fig. 3-9-16

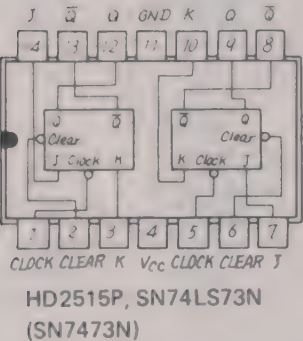


Fig. 3-9-17

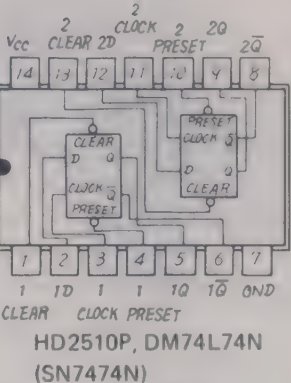


Fig. 3-9-18

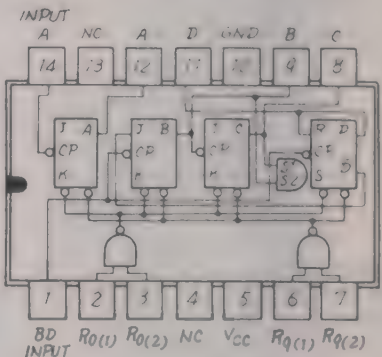


Fig. 3-9-19

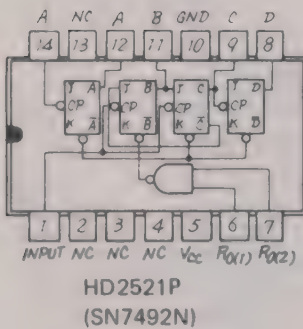


Fig. 3-9-20

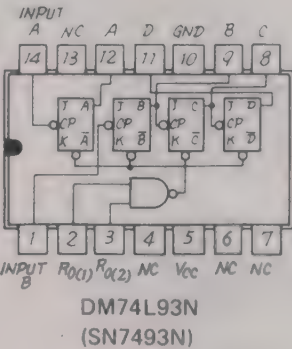


Fig. 3-9-21

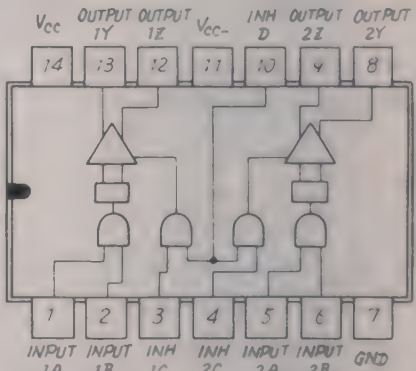


Fig. 3-9-22

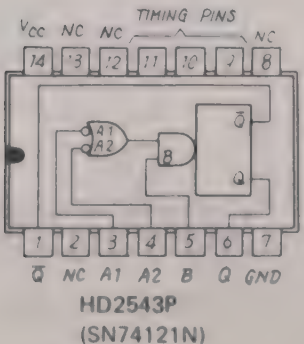


Fig. 3-9-23

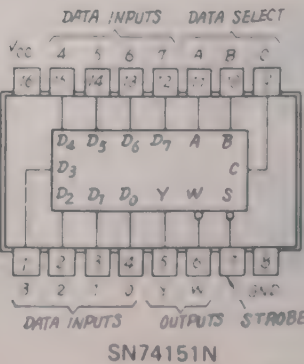
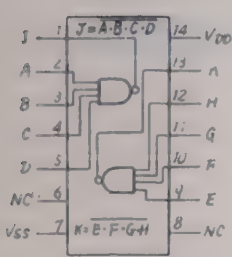
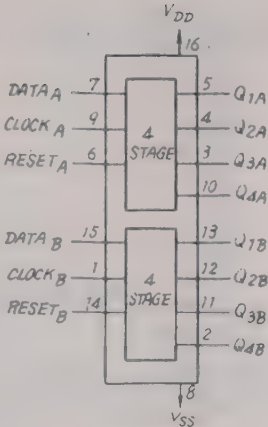


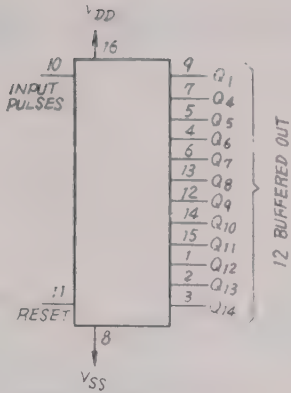
Fig. 3-9-24



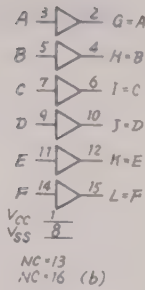
CD4012AE
Fig. 3-9-25



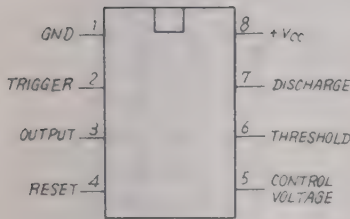
CD4015AE
Fig. 3-9-26



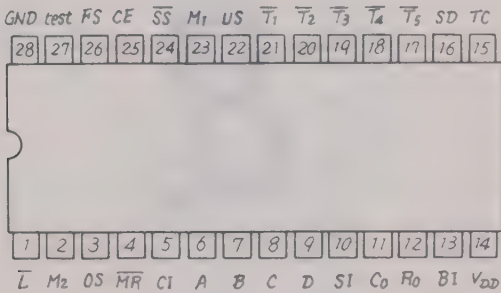
CD4020AE
Fig. 3-9-27



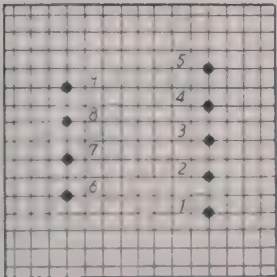
CD4050AE
Fig. 3-9-28



LM555CN
Fig. 3-9-29

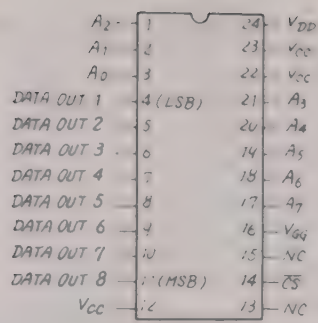


μPD851D
Fig. 3-9-30



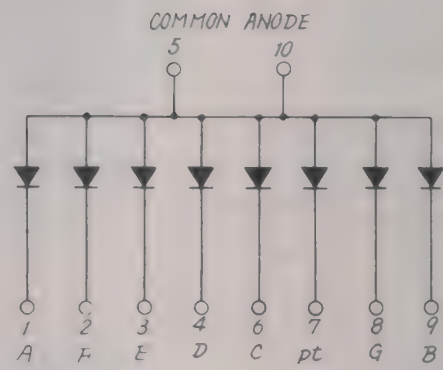
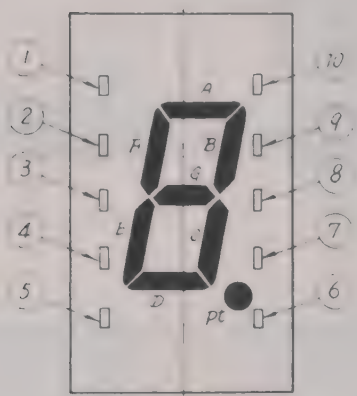
6005
Fig. 3-9-31

PIN DESIGNATION	
PIN REF	FUNCTION
1	SJ (T)
2	VOUT
3	-15 V
4	GND
5	+15 V
6	S
7	G
8	INPUT
9	TRIM.



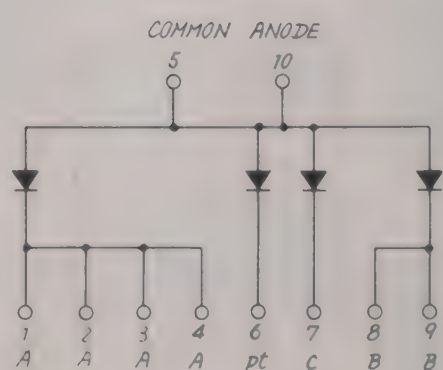
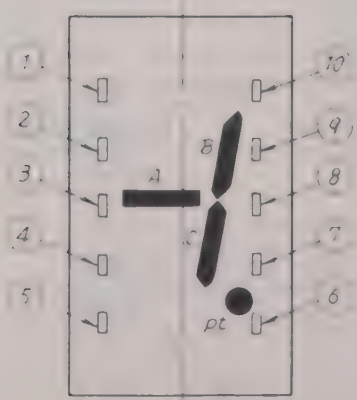
2504

Fig. 3-9-32



TLR303

Fig. 3-9-33



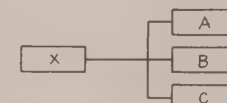
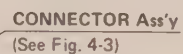
TLR304

Fig. 3-9-34

4. CIRCUIT DIAGRAMS AND PARTS LOCATION

Contents of Circuit Diagrams

Par.	Description	Ass'y No.	Fig. No.	Page
1.	DIGITAL AC METER Type 2504 ASSEMBLY DIAGRAM		4-1	4-4
2.	DISPLAY UNIT Ass'y: AS B9253CM Assemblies & Parts Location Front Panel Rear Panel	B9253CM	4-2 4-2a 4-2b	4-6
3.	CONNECTOR Ass'y	B9253CD	4-3	4-7
4.	DISPLAY UNIT Ass'y	B9253CM	4-4	4-10
5.	DISPLAY Ass'y DISPLAY (1) Ass'y: AS B9253EN Parts Location DISPLAY (2) Ass'y: AS B9253ES Parts Location	B9253EH B9253EN B9253ES	4-5a 4-5b 4-5b	4-12
6.	MOTHER BOARD Ass'y Parts Location	B9253FK B9253FK	4-6a 4-6b	4-14
7.	POWER SUPPLY Ass'y Parts Location	B9253HA B9253HA	4-7a 4-7b	4-16
8.	RANGING CARD Ass'y Parts Location	B9253HE B9253HE	4-8a 4-8b	4-18
9.	A/D CONVERTER Ass'y Parts Location	B9253HJ B9253HJ	4-9a 4-9b	4-20
10.	DUAL RMS CONVERTER Ass'y Parts Location	B9253HN B9253HN	4-10a 4-10b	4-22
11.	MULTIPLIER Ass'y Parts Location	B9253HS B9253HS	4-11a 4-11b	4-24
12.	BCD OUTPUT CONNECTOR Ass'y	B9253XA	4-12	4-26
13.	BCD OUTPUT CARD Ass'y Parts Location (Option)	B9253YA B9253YA	4-13a 4-13b	4-28



X consists of A, B, C.



X optionally comprises A.



X equals either of A, B, C .

4-4

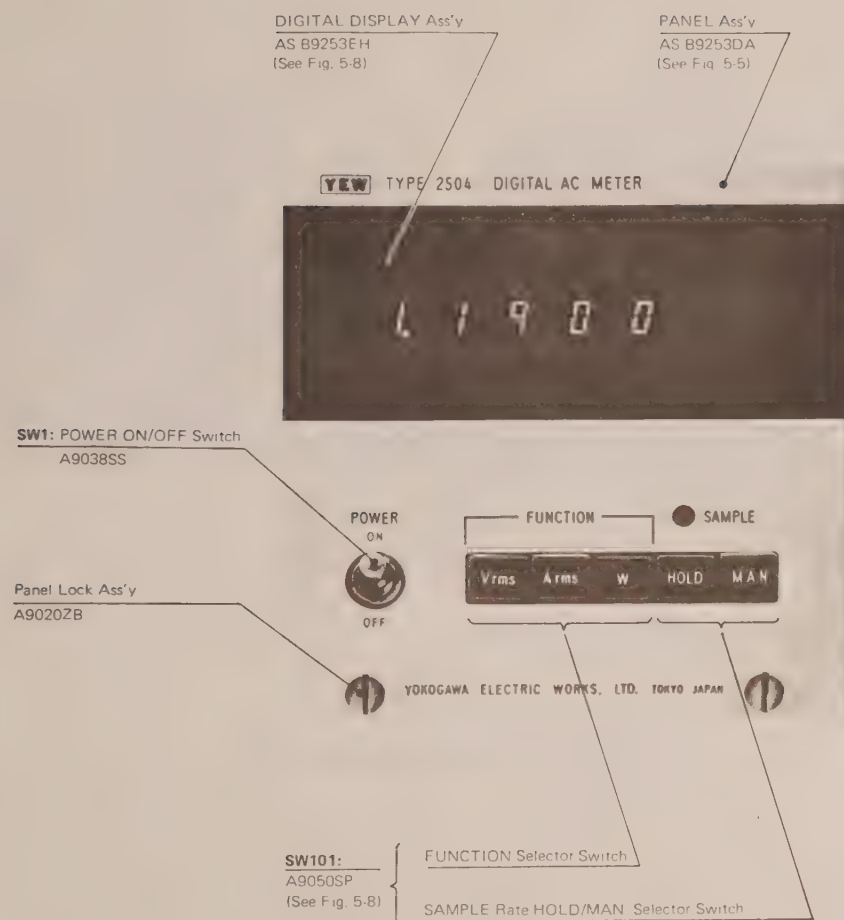


Fig. 4-2a Front Panel

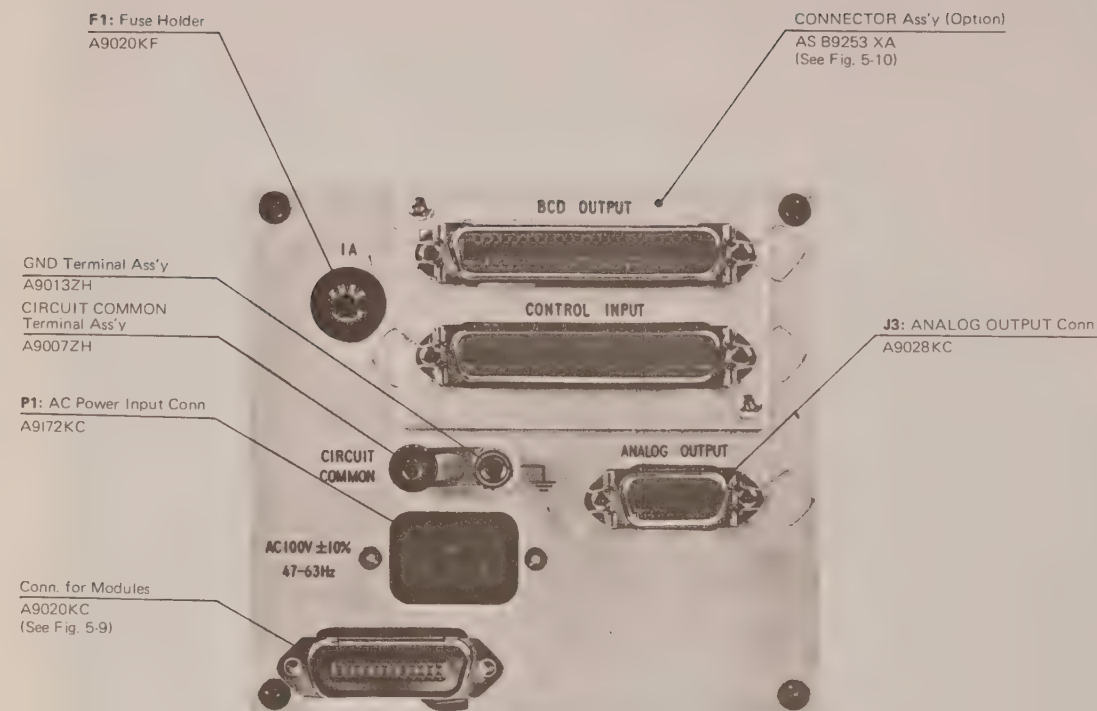
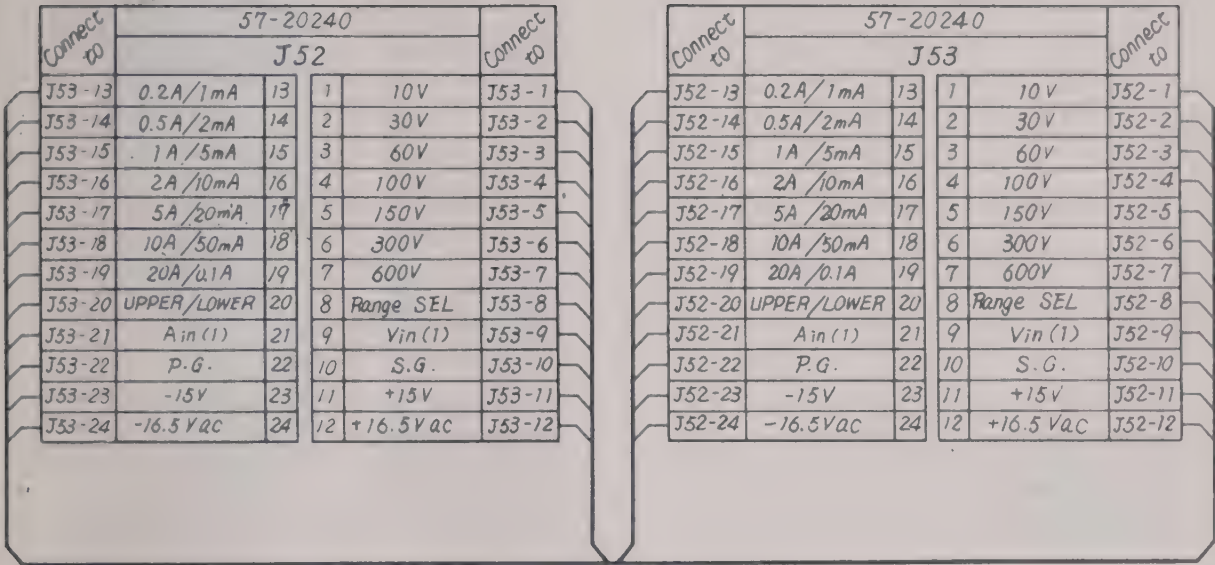


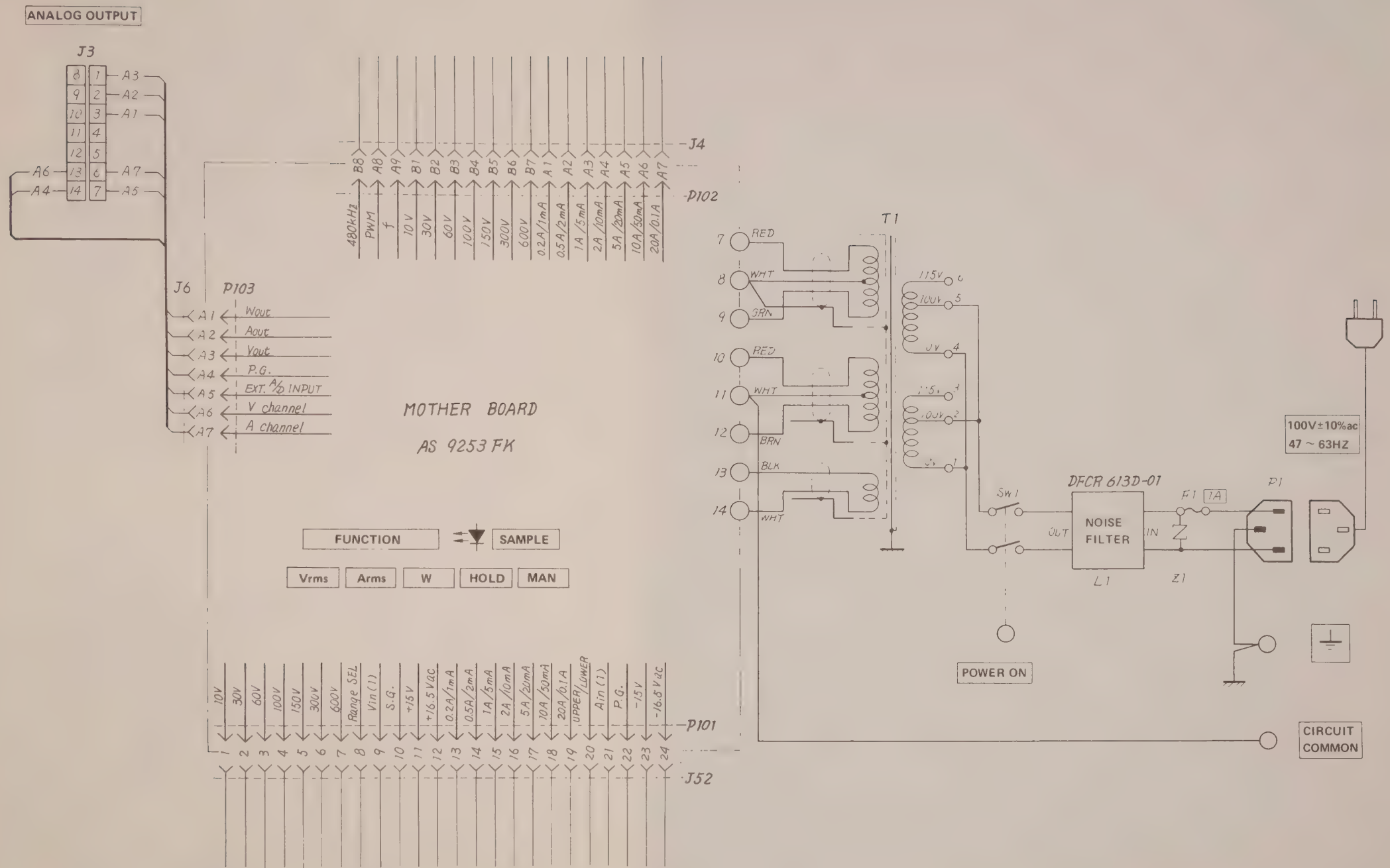
Fig. 4-2b Rear Panel

Fig. 4-2
DISPLAY UNIT Ass'y: AS B9253CM
Assemblies & Parts Location



(75-06)

Fig. 4-3 CONNECTOR Ass'y: AS B9253CD



(1'75 06)

Fig. 4-4
DISPLAY UNIT Ass'y:
AS B9253CM

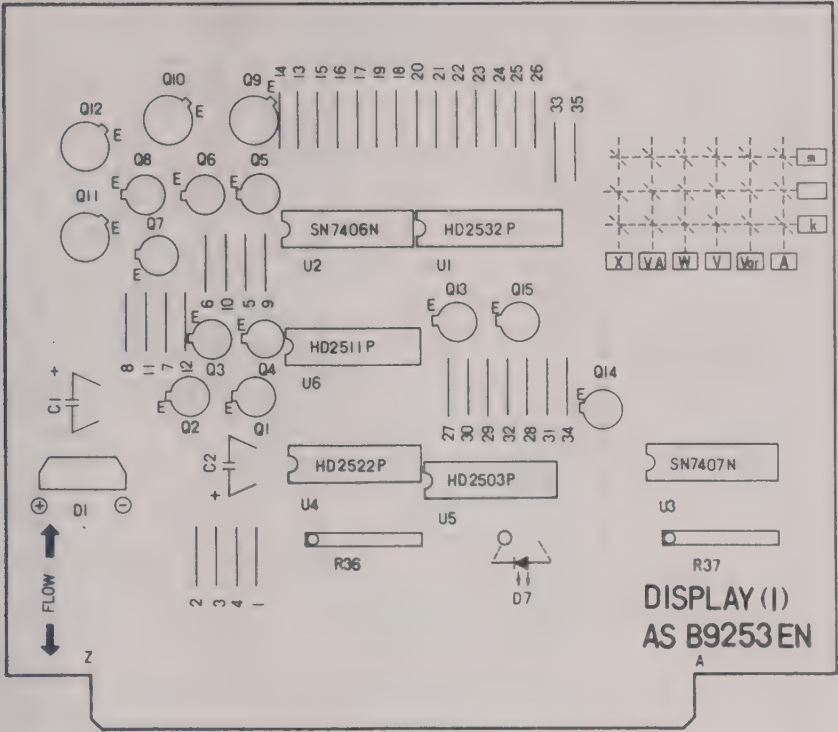


Fig. 4-5b DISPLAY (1) Ass'y: AS B9253EN Parts Location

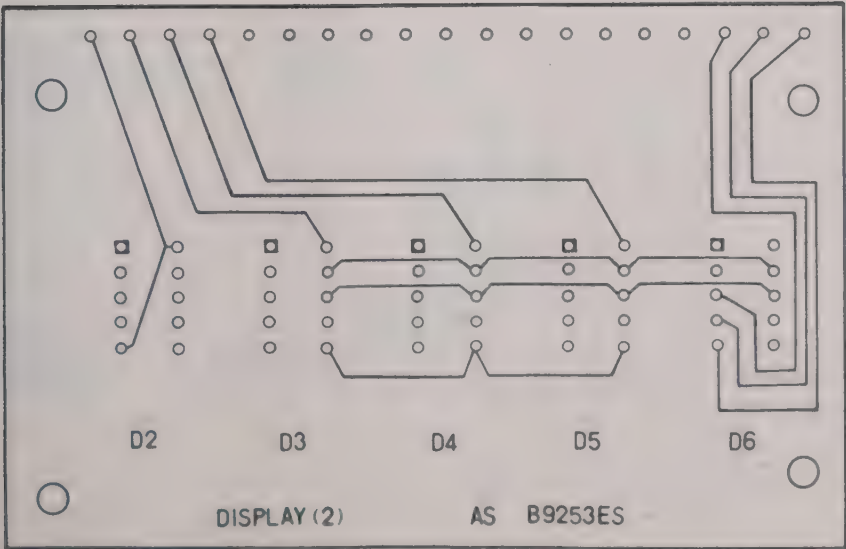


Fig. 4-5c DISPLAY (2) Ass'y: AS B9253ES Parts Location

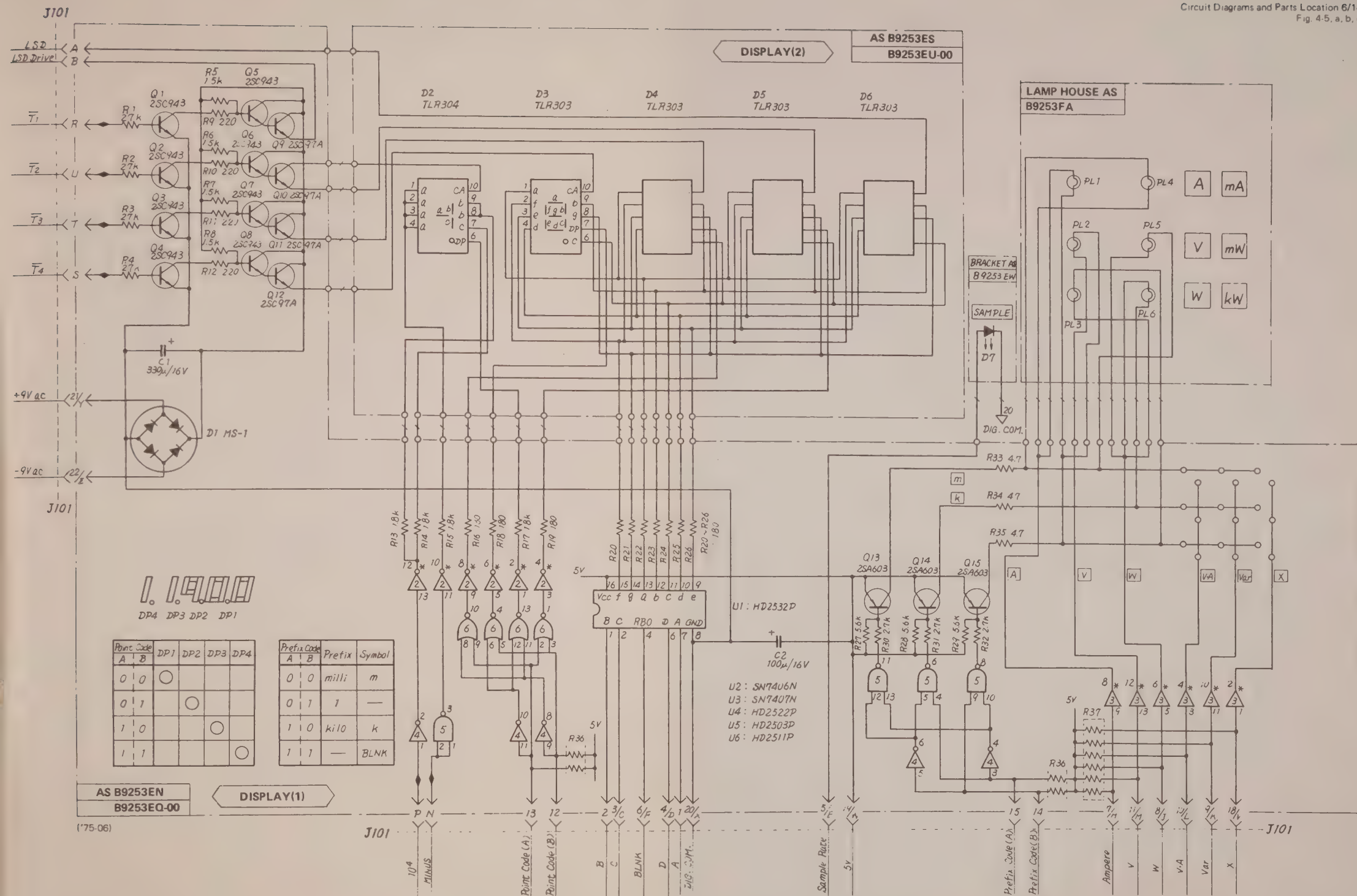
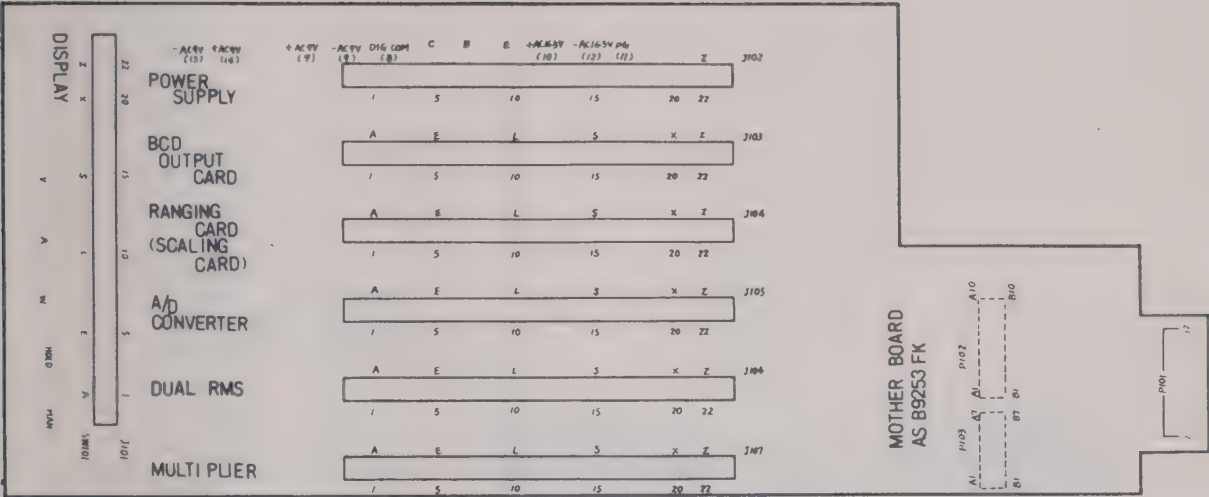


Fig. 4-5a DISPLAY Ass'y: AS B9253EH



(175-06)

Fig. 4-6b MOTHER BOARD Ass'y: AS B9253FK Parts Location



Fig. 4-6a

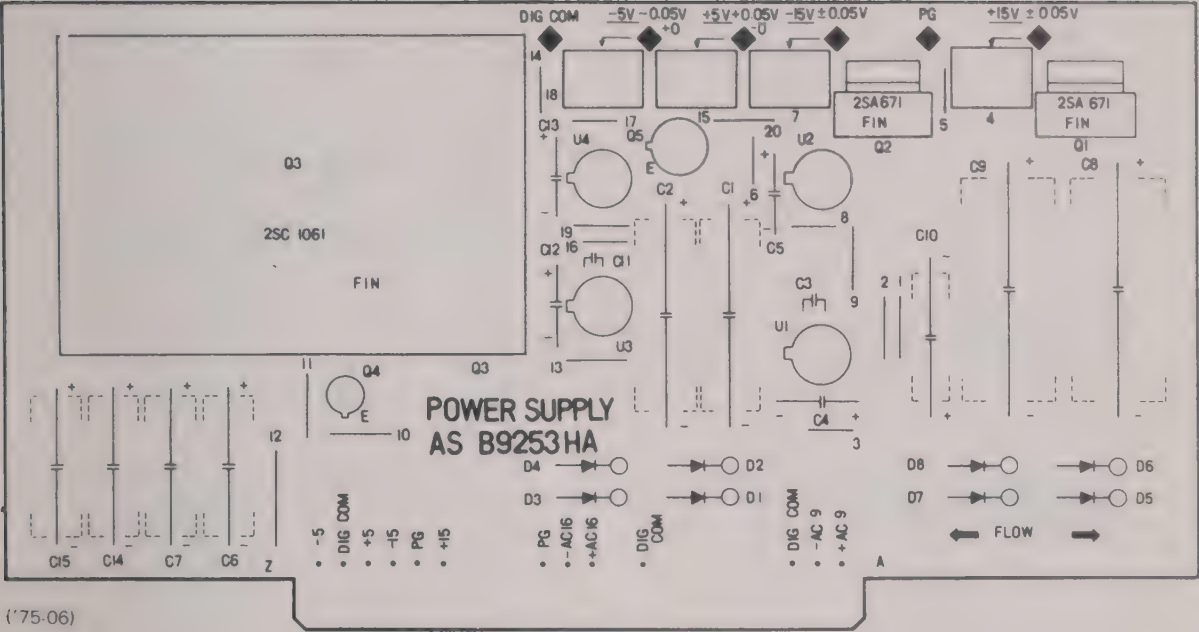


Fig. 4-7b POWER SUPPLY Ass'y: AS B9253HA Parts Location

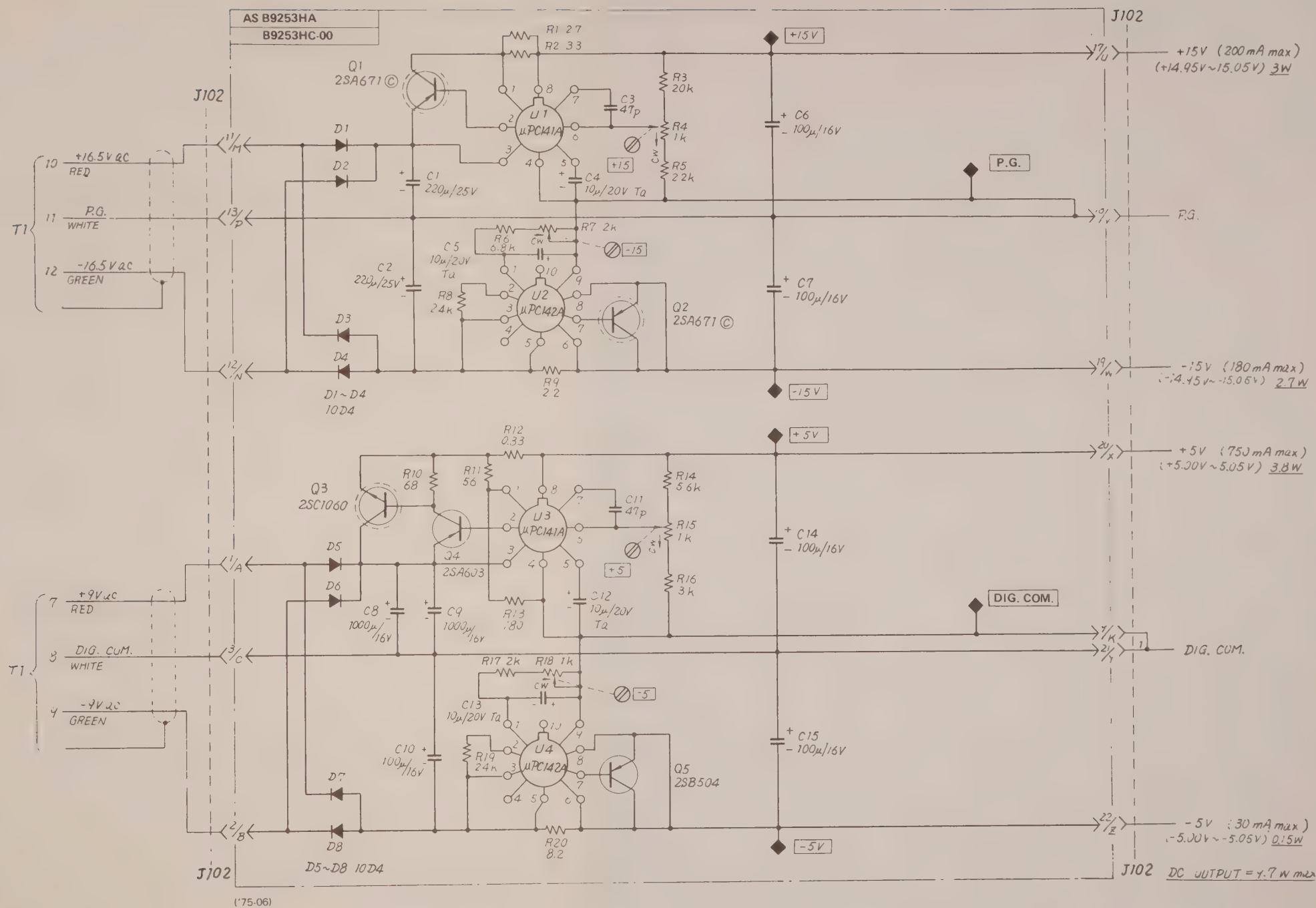


Fig. 4-7a
POWER SUPPLY Ass'y:
AS B9253HA

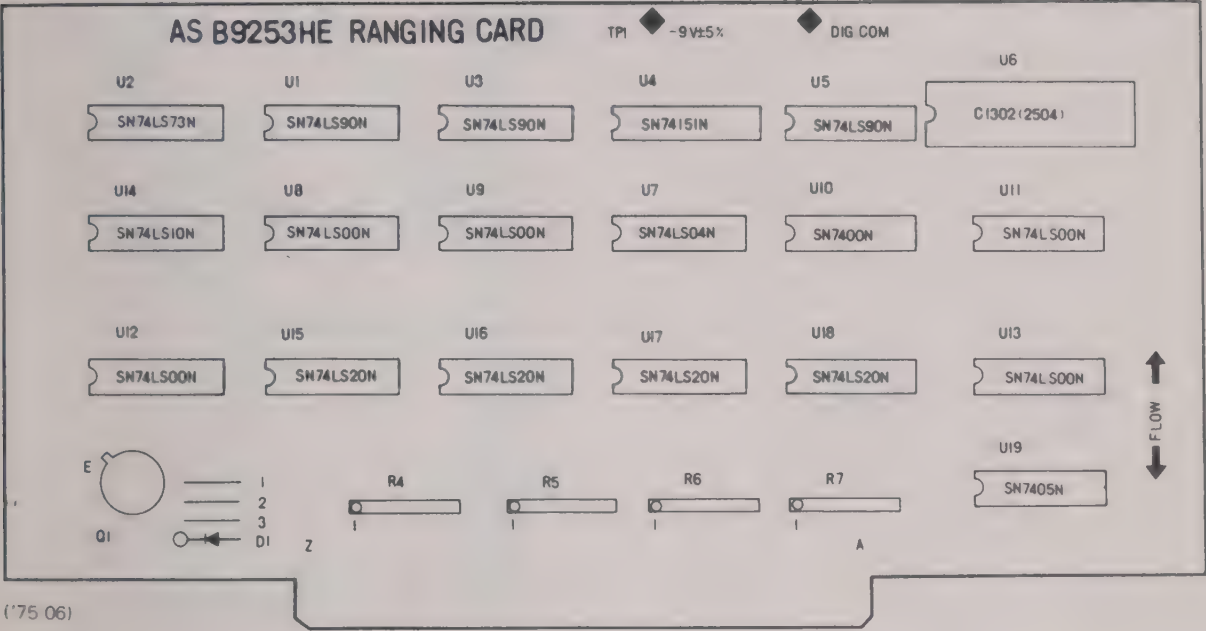


Fig. 4-8b RANGING CARD Ass'y: AS B9253HE Parts Location

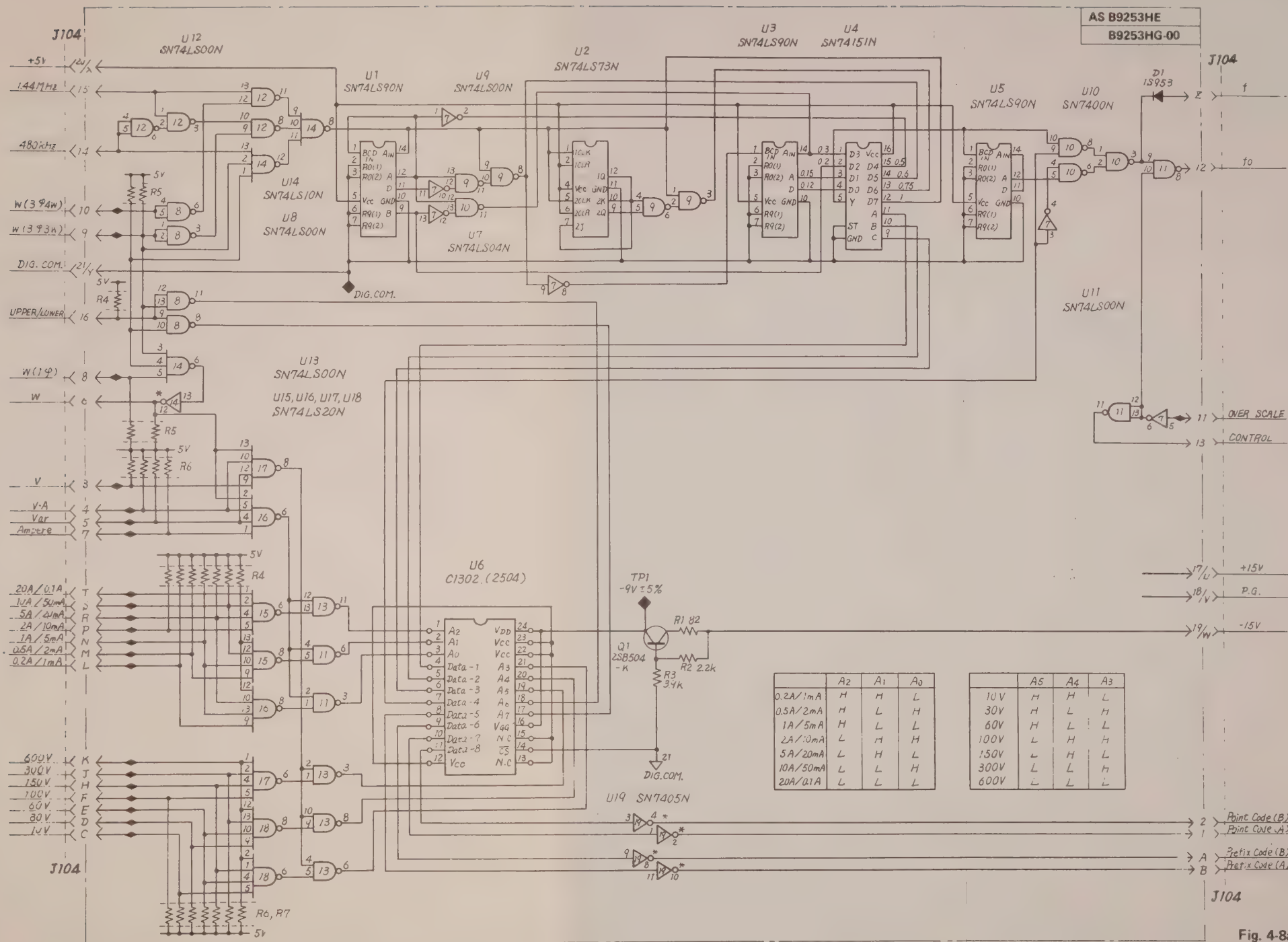


Fig. 4-8a
RANGING CARD Ass'y:
AS B9253HE

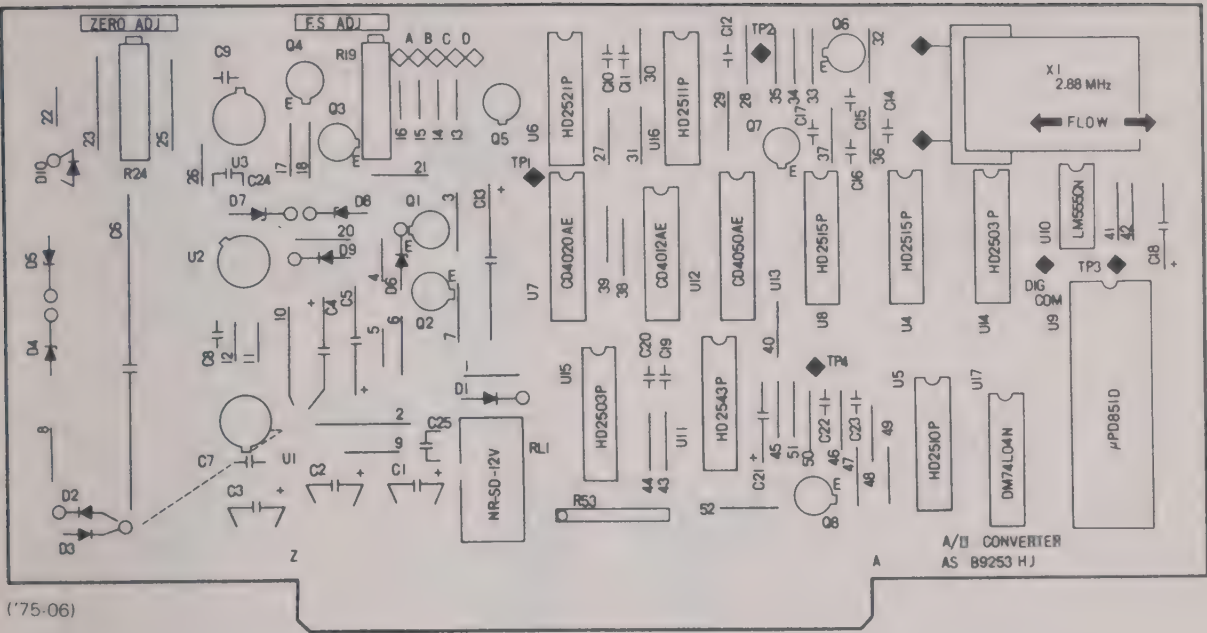
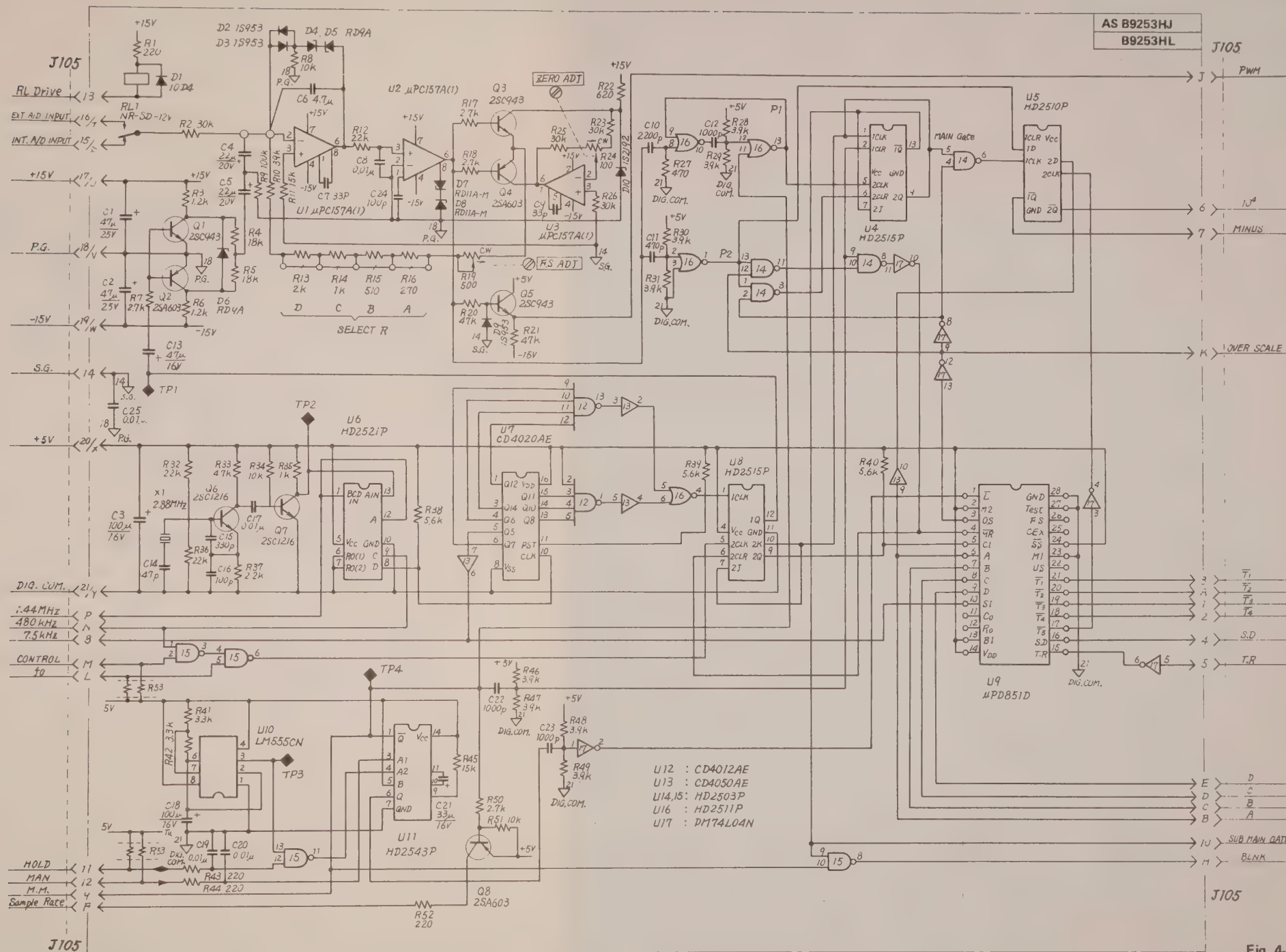


Fig. 4-9b A/D CONVERTER Ass'y: AS B9253HJ Parts Location



(175.06)

Fig. 4-9a
A/D CONVERTER Ass'y:
AS B9253HJ

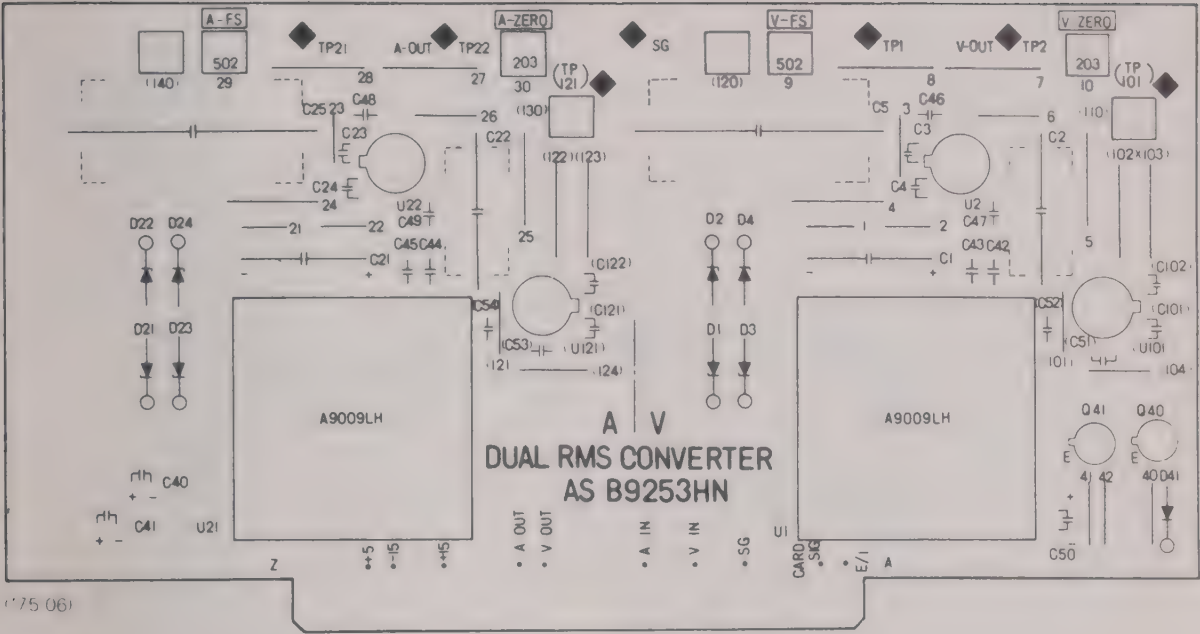


Fig. 4-10b DUAL RMS CONVERTER Ass'y: AS B9253HN Parts Location



Fig. 4-10a

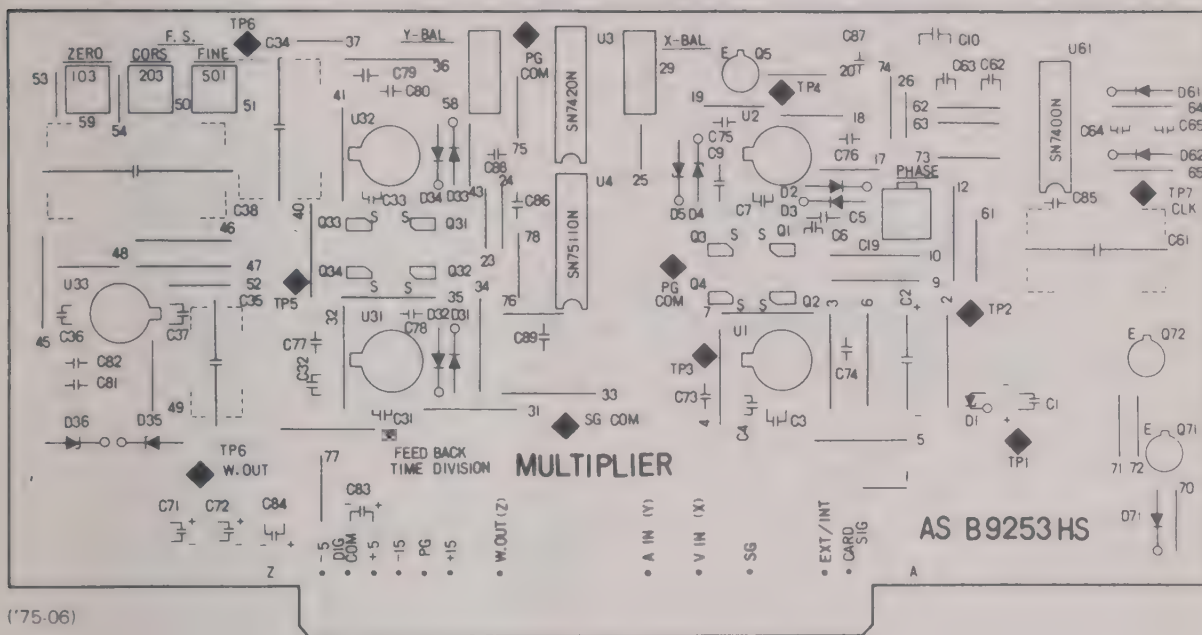
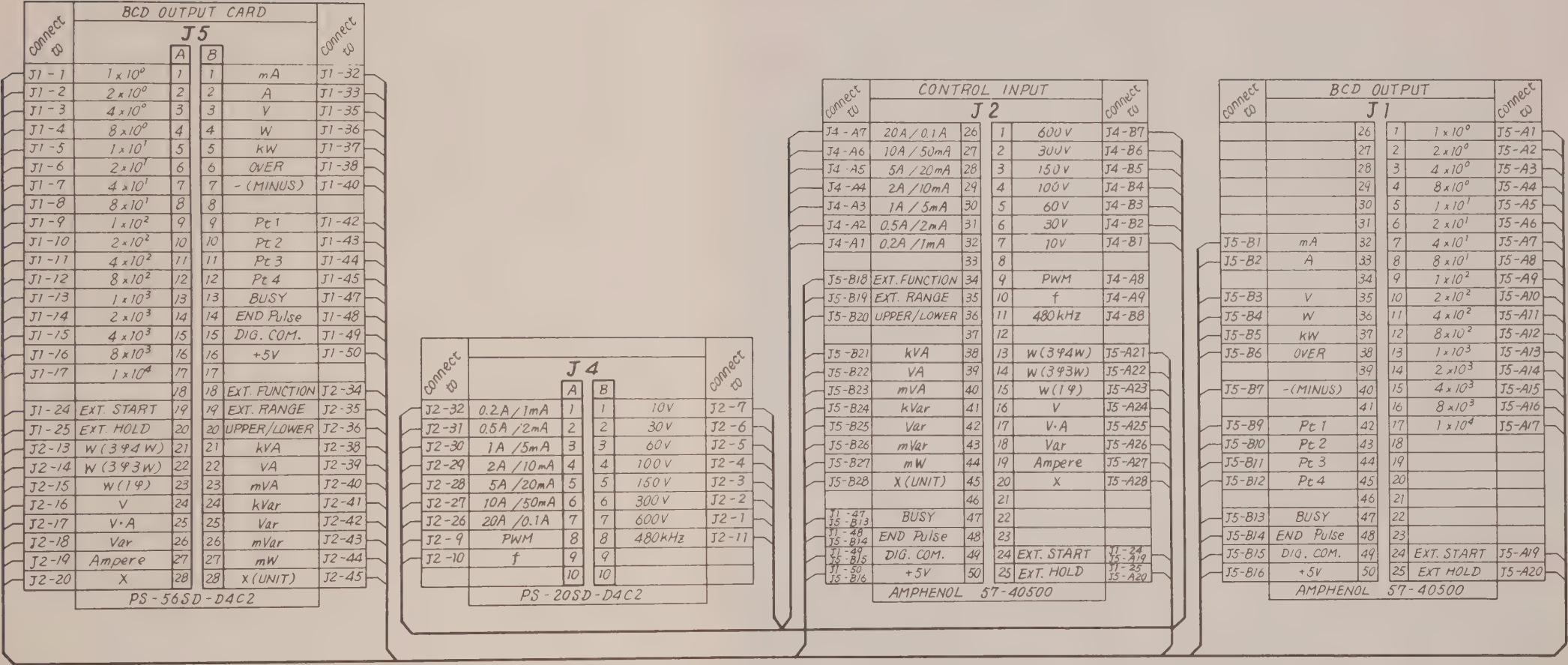


Fig. 4-11b MULTIPLIER Ass'y: AS B9253HS Parts Location



Fig. 4-11a
MULTIPLIER Ass'y:
AS B9253HS



(75-06)

Fig. 4-12
BCD OUTPUT CONNECTOR Ass'y:
AS B9253 XA (Option)

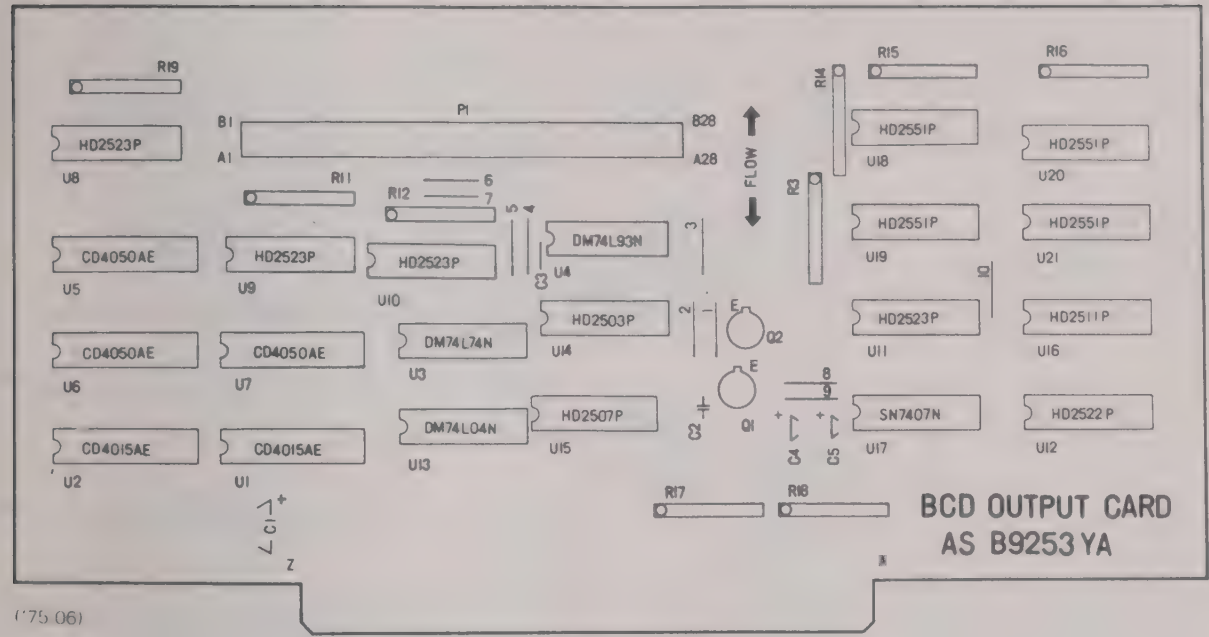


Fig. 4-13b BCD OUTPUT CARD Ass'y: AS B9253YA Parts Location (Option)

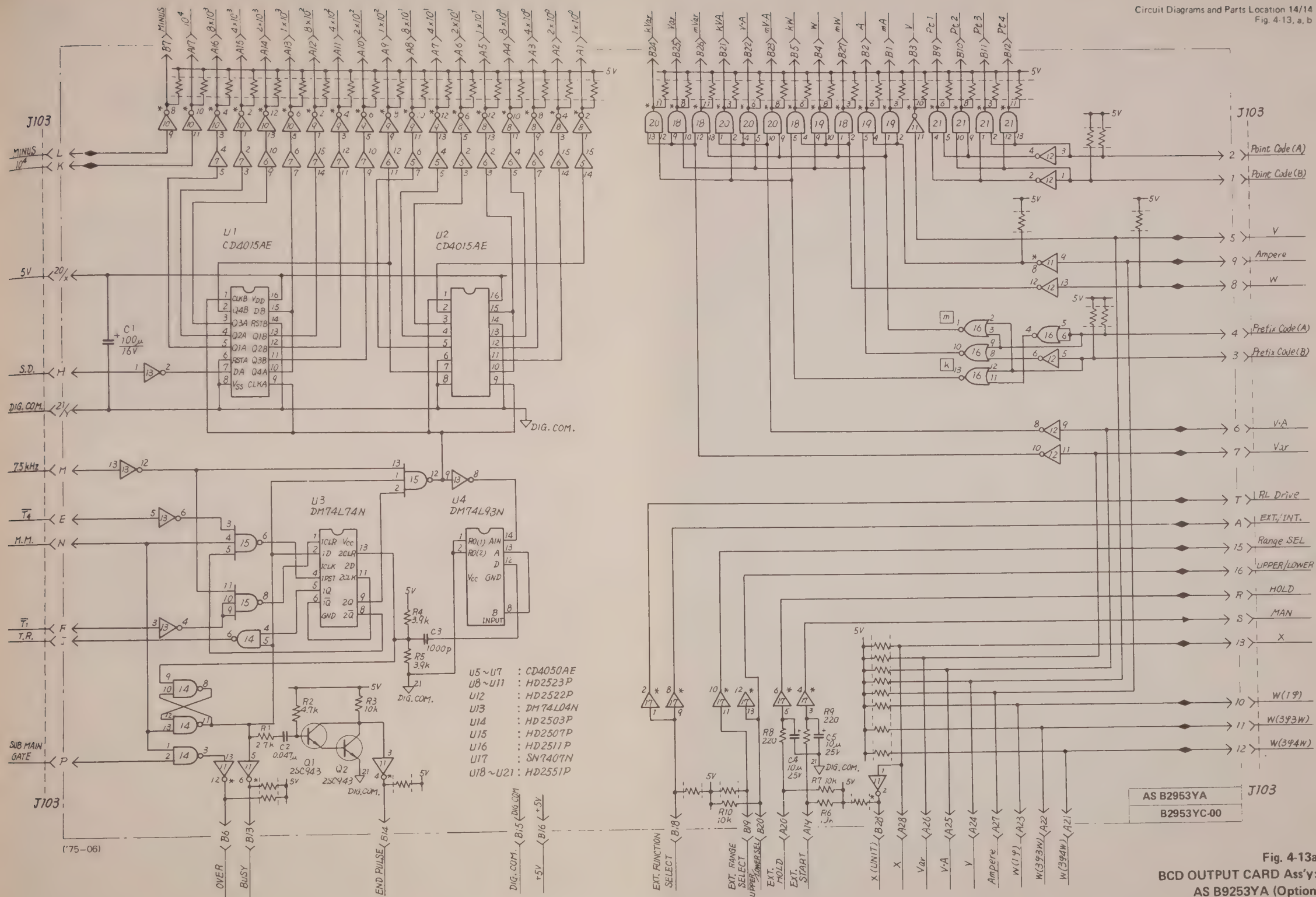


Fig. 4-13a
BCD OUTPUT CARD Ass'y
AS B2953YA (Option)

5. PARTS LIST AND ASS'Y DIAGRAMS

Contents of Parts List

Par.	Description	Ass'y No.	Fig. No.	Page
5.1	DIGITAL AC METER: Type 2504	B9253AA	—	5-3
5.2	AC METER Ass'y	B9253CA	—	5-4
5.3	CONNECTOR Ass'y	B9253CD	4-3	5-4
5.4	DISPLAY UNIT Ass'y	B9253CM	4-4	5-4
5.5	DISPLAY Ass'y	B9253EH	4-5	5-6
5.6	MOTHER BOARD Ass'y	B9253FK	4-6	5-8
5.7	POWER SUPPLY Ass'y	B9253HA	4-7	5-9
5.8	RANGING CARD Ass'y	B9253HE	4-8	5-10
5.9	A/D CONVERTER Ass'y	B9253HJ	4-9	5-11
5.10	DUAL RMS CONVERTER Ass'y	B9253HN	4-10	5-14
5.11	MULTIPLIER Ass'y	B9253HS	4-11	5-16
5.12	BCD Ass'y (Option)	B9253XX	4-12, 13	5-19

Contents of Ass'y Diagrams

Par.	Description	Ass'y No.	Fig. No.	Page
1.	DIGITAL AC METER Type 2504 ASSEMBLY DIAGRAM	—	5-1	5-24
2.	AC METER Ass'y	B9253T	5-2	5-26
3.	CONNECTOR Ass'y	B9253CD	5-3	5-28
4.	DISPLAY UNIT Ass'y	B9253CM	5-4	5-30
5.	PANEL Ass'y	B9253DA	5-5	5-32
6.	BRACKET Ass'y	B9253DK	5-6	5-34
7.	BRACKET Ass'y	B9253DU	5-7	5-36
8.	DISPLAY Ass'y	B9253EH	5-8	5-38
9.	MOTHER BOARD Ass'y	B9253FK	5-9	5-40
10.	CONNECTOR Ass'y	B9253XA	5-10	5-41

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List of abbreviations

ac	=	alternating current	JIS	=	Japanese Industrial Standard	Se	=	selenium
Ag	=	silver (ed)				sect	=	section(s)
Al	=	aluminum	L	=	inductor	Si	=	silicon
amp	=	amplifier	met	=	metal (lized)	sub-ass'y	=	sub-assembly
ass'y	=	assembly	mfr	=	manufacturer	sw	=	switch
Au	=	gold				sys	=	system
						sply	=	supply
car flm	=	carbon film	Ne	=	neon	Ta	=	tantalum
cap	=	capacitor	nom val	=	nominal value	temp	=	temperature
cct	=	circuit	OSC	=	oscillator	trim	=	trimmer
cer	=	ceramic	pcb	=	printed circuit board	TSTR	=	transistor
coef	=	coefficient	pwb	=	printed wiring board	trans	=	transformer
com	=	common	plstc	=	plastic	var	=	variable
comp	=	composition	polye	=	polyester			
conn	=	connector	polys	=	polystyrene			
			pot	=	potentiometer	ww	=	wire wound
dc	=	direct current	prec	=	precision	YEW spec	=	special
dia	=	diameter			(temperature coefficient, long term stability, and/or tolerance)			specification of
elect	=	electrolytic	res	=	resistor			Yokogawa Electric Works, Ltd.—YEW
FET	=	field effect transistor	rng	=	range			
flm	=	film	rtry	=	rotary			
fxd	=	fixed						
Ge	=	germanium						
gnd	=	ground						
IC	=	integrated circuit						

†	=	Request the item marked with † to YEW.
††	=	Replace the item marked with †† as a complete part set even when one of its parts is damaged. Request the complete part set to YEW.
†††	=	Replace the item marked with ††† as an assembly even when a part of it is damaged. Request the assembly to YEW.
††††	=	Optimum value selected at factory, average value shown (part may be omitted).

Example

Conn	:	multi = multi connector
Cap	:	fxd Al elect = Fixed aluminum electrolytic capacitor
Cap	:	fxd met polye flm = Fixed metallized polyester film capacitor
PCB ASS'Y or PCB ASSY	=	Printed circuit board assembly
Res	:	fxd car flm = Fixed carbon film resistor
Res	:	var ww = Wirewound variable resistor
Temp coef	=	Temperature coefficient

5.1 DIGITAL AC METER: Type 2504 (AS B9253AA)

5.1a DIGITAL AC METER: Type 2504-05 (AS B9253VA) *See Fig. 5-1, 2

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253CA	AC METER Ass'y	YEW	see 5.2
	B9253HS	MULTIPLIER Ass'y	YEW	see 5.11
	A9328ZJ	Name plate (2 pcs.)	YEW	
	A9329ZJ	Name plate	YEW	

5.1b DIGITAL AC METER: Type 2504-01 (AS B9253VB) *See Fig. 5-1, 2

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253VA	DIGITAL AC METER: Type 2504-05	YEW	
	B9253HE	RANGING CARD Ass'y	YEW	see 5.8

5.1c DIGITAL AC METER: Type 2504-15 (AS B9253VC) *See Fig. 5-1, 2

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253CA	AC METER Ass'y	YEW	see 5.2
	B9253HS	MULTIPLIER Ass'y	YEW	see 5.11
	B9253HN	DUAL RMS CONVERTER Ass'y	YEW	see 5.10
	A9329ZJ	Name plate	YEW	
	A9330ZJ	Name plate	YEW	
	A9331ZJ	Name plate	YEW	

5.1d DIGITAL AC METER: Type 2504-11 (AS B9253VD) *See Fig. 5-1, 2

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253VC	DIGITAL AC METER: Type 2504-15	YEW	
	B9253HE	RANGING CARD Ass'y	YEW	see 5.8

5.1e DIGITAL AC METER: Type 2504-25 (AS B9253VE) *See Fig. 5-1, 2

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253CA	AC METER Ass'y	YEW	see 5.2
	B9253HN	DUAL RMS CONVERTER Ass'y	YEW	see 5.10
	A9328ZJ	Name plate	YEW	
	A9330ZJ	Name plate	YEW	
	A9331ZJ	Name plate	YEW	

5.1 DIGITAL AC METER: Type 2504 (AS B9253AA) (continued)

5.1f DIGITAL AC METER: Type 2504-21 (AS B9253VF) *See Fig. 5-1, 2

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253VF	DIGITAL AC METER: Type 2504-25	YEW	
	B9253HE	RANGING CARD Ass'y	YEW	see 5-8

5.2 AC METER Ass'y: AS B9253CA

7-1, 102

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	Y9550CB	CASE Ass'y CA23	YEW	
	A9332ZJ	Name plate	YEW	
	A9333ZJ	Name plate	YEW	
	B9253CD	CONNECTOR Ass'y	YEW	see 5-3, Fig. 5-3
	B9253CM	DISPLAY UNIT Ass'y	YEW	see 5-4, Fig. 5-4
	Y9310GB	Screw $\phi 3, \ell 10, p0.5, GB$	YEW	
	Y9308EB	Screw (2 pcs.) $\phi 3, \ell 8, p0.5, EB$	YEW	

5.3 CONNECTOR Ass'y: AS B9253CD

7-1, 102

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253CF	Cover	YEW	
	B9253CG	Bracket	YEW	
	A9022KC	Conn: jack (2 pcs.) 57-20240	AMPHENOL	
	Y9304LB	Screw (2 pcs.) $\phi 3, \ell 4, p0.5, LB$	YEW	
	Y9208KB	Screw (4 pcs.) $\phi 2.3, \ell 8, p0.4, KB$	YEW	
	Y9230SP	Washer: spring (4 pcs.) $\phi 2.3$	YEW	
	Y9230WB	Washer (4 pcs.) $\phi 2.3$	YEW	

5.4 DISPLAY UNIT Ass'y: AS B9253CM

7-1, 102

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253CQ	Plate	YEW	
	B9253CR	Plate	YEW	
	B9253CS	Bracket (2 pcs.)	YEW	
	B9253CT	Rod (2 pcs.)	YEW	
	B9253CU	Bracket	YEW	
	B9253CV	Bracket	YEW	
	B9253CW	Plate	YEW	
	B9253DA	PANEL Ass'y	YEW	see Fig. 5-5
	B9253DF	Panel	YEW	
	A9003ZE	Screw (2 pcs.) PS-06	YEW	
	B9253DG	Holder	YEW	
	Y9805PA	Pin	YEW	

5.4 DISPLAY UNIT Ass'y: AS B9253CM (continued)

Item	Part No.	Part Name & Description			Manufacturer	Remarks
	B9253DK	BRACKET Ass'y			YEW	see Fig. 5-6
	B9253DN	Bracket			YEW	
	B9253DP	Rod			YEW	
	Y9306JB	Screw	(2 pcs.)	φ3, φ6, p0.5, JB	YEW	
	Y9308EB	Screw	(2 pcs.)	φ3, φ8, p0.5, EB	YEW	
	A9019KX	Nut	(2 pcs.)	409S	YEW	
	B9253DU	BRACKET Ass'y			YEW	see Fig. 5-7
	B9253DX	Bracket			YEW	
	Y9306JB	Screw	(2 pcs.)	φ3, φ6, p0.5, JB	YEW	
	A9019KX	Nut		409S	YEW	
	B9253EA	Panel			YEW	see 5.5, Fig. 5-8 see 5.6, Fig. 5-9
	B9253EH	DISPLAY Ass'y			YEW	
	B9253FK	MOTHER BOARD Ass'y			YEW	
	B9253CX	Rod			YEW	
	B9253CY	Bracket			YEW	
	A9013YC	Bracket	(14 pcs.)	PG02-00	YEW	
	A9020ZB	Panel Lock Ass'y	(2 pcs.)	CD03	YEW	
	A9007ZH	Terminal Ass'y		TM01-B	YEW	
	A9013ZH	Terminal Ass'y		TM03	YEW	
	Y9641TM	Short bar			YEW	
SW1	A9038SS	SW: toggle		S-332	Nihon Kaiheiki	
P1	A9172KC	Conn. jack		EAC-301	SWITCHCRAFT	
	A9028YF	Cable Ass'y		PC01	Hanai Densen	
	B9253CZ	Bracket			YEW	
F1	A9020KF	Fuse holder			S-N1301	Showa Musen
	S9025KF	Fuse (1A)			S-M1101=1	Showa Musen
T1	A9308MT	Trans: power			CS-25	YEW
L1	A9001EF	Filter: noise			DFCR613D-01	TDK
J3	A9028KC	Conn: jack			57-40140	AMPHENOL
	G9006VN	Flat cable (20cm)				
J6	A9107KP	Conn: jack		PS-14SD-D402	JAE	circular nut
	A9120KP	Socket contact	(14 pcs.)	PS-SD-C2N-1	JAE	
	Y9305EB	Screw	(12 pcs.)	φ3, φ5, p0.5, EB	YEW	
	Y9204KB	Screw	(2 pcs.)	φ2.3-φ4, p0.4, KB	YEW	
	Y9206KB	Screw	(2 pcs.)	φ2.3-φ6, p0.4, KB	YEW	
	Y9304JB	Screw		φ3-φ4, p0.5, JB	YEW	
	Y9308LB	Screw	(14 pcs.)	φ3-φ8, p0.5, LB	YEW	
	Y9310LB	Screw	(4 pcs.)	φ3-φ10, p0.5, LB	YEW	
	Y9306EB	Screw	(6 pcs.)	φ3-φ6, p0.5, EB	YEW	
	Y9308EB	Screw	(2 pcs.)	φ3-φ8, p0.5, EB	YEW	
	Y9310GB	Screw	(2 pcs.)	φ3-φ10, p0.5, GB	YEW	
	Y9406EB	Screw	(4 pcs.)	φ4-φ6, p0.7, EB	YEW	
	Y9410EB	Screw	(4 pcs.)	φ4, φ10, p0.7, EB	YEW	
	Y9301BB	Nut	(6 pcs.)	M3 x 0.5	YEW	
	Y9300SP	Washer spring	(9 pcs.)	φ3	YEW	
	Y9300WB	Washer	(9 pcs.)	φ3	YEW	
	B9253HA	POWER SUPPLY Ass'y			YEW	see 5.7
	B9253HU	A/D CONVERTER Ass'y			YEW	see 5.9

5.4 DISPLAY UNIT Ass'y: AS B9253CM (continued)

Item	Part No.	Part Name & Description		Manufacturer	Remarks
Z1	A9010HV	Varistor	ERZ-A14DL221	Matsushita	for 100 to 115V power input for 200 to 230V power input
	A9011HV	Varistor	ERZ-A14DL441	Matsushita	

5.5 DISPLAY Ass'y: AS B9253EH

(75-08)

Item	Part No.	Part Name & Description		Manufacturer	Remarks
	B9253EN	DISPLAY (1) Ass'y		YEW	see 5.5.1
	B9253ES	DISPLAY (2) Ass'y		YEW	see 5.5.2
	A9001WF	Flat cable		Sumitomo	19x4mm pitch
	B9253EL	Rod	(4 pcs.)	YEW	see 5.5.3, Fig. 5-8 see 5.5.4, Fig. 5-8
	B9253EW	BRACKET Ass'y		YEW	
	B9253FA	LAMP HOUSE Ass'y		YEW	
	Y9305LB	Screw	(8 pcs.) $\phi 3, \phi 5, p0.5, LB$	YEW	
	Y9305LE	Screw	(4 pcs.) $\phi 3, \phi 5, p0.5, LE$	YEW	

5.5.1 DISPLAY (1) Ass'y: AS B9253EN

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R1	A9050RS	Res: fxd car comp	27k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF27k Ω K		
R2	A9050RS	Res: fxd car comp	27k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF27k Ω K		
R3	A9050RS	Res: fxd car comp	27k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF27k Ω K		
R4	A9050RS	Res: fxd car comp	27k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF27k Ω K		
R5	A9035RS	Res: fxd car comp	1.5k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.5k Ω K		
R6	A9035RS	Res: fxd car comp	1.5k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.5k Ω K		
R7	A9035RS	Res: fxd car comp	1.5k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.5k Ω K		
R8	A9035RS	Res: fxd car comp	1.5k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.5k Ω K		
R9	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF220 Ω K		
R10	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF220 Ω K		
R11	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF220 Ω K		
R12	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF220 Ω K		
R13	A9036RS	Res: fxd car comp	1.8k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.8k Ω K		
R14	A9036RS	Res: fxd car comp	1.8k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.8k Ω K		
R15	A9036RS	Res: fxd car comp	1.8k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.8k Ω K		
R16	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R17	A9036RS	Res: fxd car comp	1.8k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF1.8k Ω K		
R18	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R19	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R20	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R21	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R22	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R23	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R24	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R25	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R26	A9024RS	Res: fxd car comp	180 Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R27	A9042RS	Res: fxd car comp	5.6k Ω	$\pm 10\%$	$\frac{1}{4}W$ RC $\frac{1}{4}$ GF5.6k Ω K		

5.5.1 DISPLAY (1) Ass'y: AS B9253EN (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R28	A9042RS	Res: fxd car comp	5.6kΩ	±10%	¼W RC%GF5.6kΩK		
R29	A9042RS	Res: fxd car comp	5.6kΩ	±10%	¼W RC%GF5.6kΩK		
R30	A9038RS	Res: fxd car comp	2.7kΩ	±10%	¼W RC%GF2.7kΩK		
R31	A9038RS	Res: fxd car comp	2.7kΩ	±10%	¼W RC%GF2.7kΩK		
R32	A9038RS	Res: fxd car comp	2.7kΩ	±10%	¼W RC%GF2.7kΩK		
R33	A9005RS	Res: fxd car comp	4.7Ω	±10%	¼W RC%GF4.7ΩK		
R34	A9005RS	Res: fxd car comp	4.7Ω	±10%	¼W RC%GF4.7ΩK		
R35	A9005RS	Res: fxd car comp	4.7Ω	±10%	¼W RC%GF4.7ΩK		
R36	A9018RL	Res: module			RK 1/8B610kΩ	Koa Denko	
R37	A9018RL	Res: module			RK 1/8B610kΩ	Koa Denko	
C1	A9022CA	Cap: fxd Al elect	330μF		16V ECE-A16V330L	Matsushita	
C2	A9019CA	Cap: fxd Al elect	100μF		16V ECE-A16V100L	Matsushita	
D1	A9010HL	Diode: stack			MS-1	IRC Japan	
Q1	G9140HQ	TSTR			2SC943	NEC	
Q2	G9140HQ	TSTR			2SC943	NEC	
Q3	G9140HQ	TSTR			2SC943	NEC	
Q4	G9140HQ	TSTR			2SC943	NEC	
Q5	G9140HQ	TSTR			2SC943	NEC	
Q6	G9140HQ	TSTR			2SC943	NEC	
Q7	G9140HQ	TSTR			2SC943	NEC	
Q8	G9140HQ	TSTR			2SC943	NEC	
Q9	S9097HC	TSTR			2SC97A	NEC	
Q10	S9097HC	TSTR			2SC97A	NEC	
Q11	S9097HC	TSTR			2SC97A	NEC	
Q12	S9097HC	TSTR			2SC97A	NEC	
Q13	G9141HQ	TSTR			2SA603	NEC	
Q14	G9141HQ	TSTR			2SA603	NEC	
Q15	G9141HQ	TSTR			2SA603	NEC	
U1	A9037LB	IC			HD2532P	Hitachi	equivalent to SN7447N
U2	A9020LB	IC			SN7406N	TEXAS INST.	
U3	A9021LB	IC			SN7407N	TEXAS INST.	
U4	A9018LB	IC			HD2522P	Hitachi	equivalent to SN7404N
U5	A9014LB	IC			HD2503P	Hitachi	equivalent to SN7400N
U6	A9016LB	IC			HD2511P	Hitachi	equivalent to SN7402N
	B9253EQ	Printed Wiring Board				YEW	
	A9003YC	Lever	(2 pcs.)		PG01-00	YEW	
	Y9706PS	Pin	(2 pcs.)			YEW	

5.5.2 DISPLAY (2) Ass'y: AS B9253ES

Item	Part No.	Part Name & Description				Manufacturer	Remarks
D2	A9013HP	Diode LED			TLR304	Toshiba	
D3	A9012HP	Diode LED			TLR303	Toshiba	

5.5.2 DISPLAY (2) Ass'y: AS B9253ES (continued)

Item	Part No.	Part Name & Description	Manufacturer	Remarks
D4	A9012HP	Diode: LED TLR303	Toshiba	
D5	A9012HP	Diode: LED TLR303	Toshiba	
D6	A9012HP	Diode: LED TLR303	Toshiba	
	B9253EU	Printed Wiring Board	YEW	

5.5.3 BRACKET Ass'y: AS B9253EW

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253EY	Bracket	YEW	
	B9250DE	Collar	YEW	
	B9250DF	Collar	YEW	
D7	A9017HP	Diode: LED OLD-419	OKI	

5.5.4 LAMP HOUSE Ass'y: AS B9253FA

Item	Part No.	Part Name & Description	Manufacturer	Remarks
	B9253FD	Scale plate	YEW	
	B9253FE	Case	YEW	
	B9253FF	Plate	YEW	
	B9253FG	Rod (2 pcs.)	YEW	
PL1	A9030EH	Lamp 5V 40mA L=20 OL-3007BPC	Oshino	
PL2	A9030EH	Lamp OL-3007BPC	Oshino	
PL3	A9030EH	Lamp OL-3007BPC	Oshino	
PL4	A9030EH	Lamp OL-3007BPC	Oshino	
PL5	A9030EH	Lamp OL-3007BPC	Oshino	
PL6	A9030EH	Lamp OL-3007BPC	Oshino	
	Y9314EE	Screw (2 pcs.) $\phi 3, \ell 14, p0.5, EE$	YEW	

5.6 MOTHER BOARD Ass'y: AS B9253FK

(75-08)

Item	Part No.	Part Name & Description	Manufacturer	Remarks
J101	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
J102	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
J103	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
J104	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
J105	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
J106	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
J107	A9011KP	Conn: jack 225J-22221-187 (115)	Daichi Denshi	
P101	A9020KC	Conn: plug 57-10240	AMPHENOL	
P102	A9105KP	Conn: plug PS-20PA-D4LT1-A1	JAE	
P103	A9104KP	Conn: plug PS-14PA-D4LT1-A1	JAE	
SW101	A9050SP	SW: push button	Alps	

5.6 MOTHER BOARD Ass'y: AS B9253FK (continued)

Item	Part No.	Part Name & Description		Manufacturer	Remarks
	B9253FO	Printed Wiring Board		YEW	
	A9038ZG	Knob	(5 pcs.)	YEW	
	B9253FU	Bracket		YEW	
	B9253FX	Bracket		YEW	
	Y9206KB	Screw	(2 pcs.) $\phi 2.3, \phi 6, p0.5, KB$	YEW	
	Y9230SP	Washer: spring	(2 pcs.) $\phi 2.3$	YEW	
	Y9230WB	Washer	(2 pcs.) $\phi 2.3$	YEW	
	A9018KX	Nut	(8 pcs.) 309S	YEW	

5.7 POWER SUPPLY Ass'y: AS B9253HA

('75-08)

Item	Part No.	Part Name & Description		Manufacturer	Remarks
R1	A9002RS	Res: fxd car comp	2.7 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF2.7 Ω K		
R2	A9003RS	Res: fxd car comp	3.3 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF3.3 Ω K		
R3	A9171RM	Res: fxd met flm	20k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR20k Ω J	Susumu	
R4	S9016RV	Res: var ww	1k Ω $\pm 10\%$ $\frac{1}{4}W$ λ -13S 1k Ω	Copal	
R5	A9148RM	Res: fxd met flm	2.2k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR2.2k Ω J	Susumu	
R6	A9160RM	Res: fxd met flm	6.8k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR6.8k Ω J	Susumu	
R7	S9017RV	Res: var ww	2k Ω $\pm 10\%$ $\frac{1}{4}W$ λ -13S 2k Ω	Copal	
R8	A9149RM	Res: fxd met flm	2.4k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR2.4k Ω J	Susumu	
R9	A9001RS	Res: fxd car comp	2.2 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF2.2 Ω K		
R10	A9019RS	Res: fxd car comp	68 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF68 Ω K		
R11	A9018RS	Res: fxd car comp	56 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF56 Ω K		
R12	A9925RN	Res: fxd met flm	0.33 Ω $\pm 10\%$ 1W RN1-1 0.33 Ω K	Kamaya	
R13	A9024RS	Res: fxd car comp	180 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF180 Ω K		
R14	A9158RM	Res: fxd met flm	5.6k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR5.6k Ω K	Susumu	
R15	S9016RV	Res: var ww	1k Ω $\pm 10\%$ $\frac{1}{4}W$ λ -13S 1k Ω	Copal	
R16	A9151RM	Res: fxd met flm	3k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR3k Ω J	Susumu	
R17	A9147RM	Res: fxd met flm	2k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR2k Ω J	Susumu	
R18	S9016RV	Res: var ww	1k Ω $\pm 10\%$ $\frac{1}{4}W$ λ -13S 1k Ω	Copal	
R19	A9149RM	Res: fxd met flm	2.4k Ω $\pm 5\%$ $\frac{1}{4}W$ RE50YR2.4k Ω J	Susumu	
R20	A9008RS	Res: fxd car comp	8.2 Ω $\pm 10\%$ $\frac{1}{4}W$ RC $\frac{1}{4}$ GF8.2 Ω K		
C1	A9120CA	Cap: fxd Al elect	220 μ F 25V ECE-B25V220L	Matsushita	
C2	A9120CA	Cap: fxd Al elect	220 μ F 25V ECE-B25V220L	Matsushita	
C3	A9056CN	Cap: fxd mica	47pF $\pm 10\%$ 100V DM15C470K1	Nitsuko	
C4	G9121CT	Cap: fxd Ta elect	10 μ F $\pm 20\%$ 20V TAXB2002-106M	Matsuo	
C5	G9121CT	Cap: fxd Ta elect	10 μ F $\pm 20\%$ 20V TAXB2002-106M	Matsuo	
C6	A9096CA	Cap: fxd Al elect	100 μ F 16V ECE-B16V100L	Matsushita	
C7	A9096CA	Cap: fxd Al elect	100 μ F 16V ECE-B16V100L	Matsushita	
C8	A9103CA	Cap: fxd Al elect	1000 μ F 16V ECE-B16V1000L	Matsushita	
C9	A9103CA	Cap: fxd Al elect	1000 μ F 16V ECE-B16V1000L	Matsushita	
C10	A9096CA	Cap: fxd Al elect	100 μ F 16V ECE-B16V100L	Matsushita	
C11	A9056CN	Cap: fxd mica	47pF $\pm 10\%$ 100V DM15C470K1	Nitsuko	
C12	G9121CT	Cap: fxd Ta elect	10 μ F $\pm 20\%$ 20V TAXB2002-106M	Matsuo	
C13	G9121CT	Cap: fxd Ta elect	10 μ F $\pm 20\%$ 20V TAXB2002-106M	Matsuo	
C14	A9096CA	Cap: fxd Al elect	100 μ F 16V ECE-B16V100L	Matsushita	

5.7 POWER SUPPLY Ass'y: AS B9253HA (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
C15	A9096CA	Cap: fxd Al elect	100 μ F	16V	ECE-B16V100L	Matsushita	
D1	G9004HR	Diode		10D4		IRC Japan	
D2	G9004HR	Diode		10D4		IRC Japan	
D3	G9004HR	Diode		10D4		IRC Japan	
D4	G9004HR	Diode		10D4		IRC Japan	
D5	G9004HR	Diode		10D4		IRC Japan	
D6	G9004HR	Diode		10D4		IRC Japan	
D7	G9004HR	Diode		10D4		IRC Japan	
D8	G9004HR	Diode		10D4		IRC Japan	
Q1	A9045HQ	TSTR		2SA671 ③		Hitachi	
Q2	A9045HQ	TSTR		2SA671 ③		Hitachi	
Q3	A9147HQ	TSTR		2SC1060 ③		Hitachi	
Q4	G9141HQ	TSTR		2SA603		NEC	
Q5	A9059HQ	TSTR		2SB504		NEC	
U1	A9006LA	IC		μ PC141A		NEC	
U2	A9007LA	IC		μ PC142A		NEC	
U3	A9006LA	IC		μ PC141A		NEC	
U4	A9007LA	IC		μ PC142A		NEC	
	A9069KH	Heat sink	(2 pcs.)	HS-SB-7-AN-11		OS	
	A9055KH	Heat sink		HS-FT-50-24-P-AN-0		OS	
	B9253HC	Printed Wiring Board				YEW	
	A9030YC	Test point	(6 pcs.)			YEW	
	A9003YC	Lever	(2 pcs.)	PG01-00		YEW	
	Y9706PS	Pin	(2 pcs.)			YEW	

5.8 RANGING CARD Ass'y: AS B9253HE

(75-08)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R1	A9020RS	Res: fxd car comp	82 Ω	$\pm 10\%$	$\frac{1}{4}$ W RC4GF82 Ω K		
R2	A9361RM	Res: fxd met flm	2.2k Ω	$\pm 2\%$	0.4W MR-25 2.2k Ω G	PHILIPS	
R3	A9367RM	Res: fxd met flm	3.9k Ω	$\pm 2\%$	0.4W MR-25 3.9k Ω G	PHILIPS	
R4	A9019RL	Res: fxd module			RK $\frac{1}{8}$ B6 10k Ω	Koa Denko	
R5	A9019RL	Res: fxd module			RK $\frac{1}{8}$ B6 10k Ω	Koa Denko	
R6	A9019RL	Res: fxd module			RK $\frac{1}{8}$ B6 10k Ω	Koa Denko	
R7	A9019RL	Res: fxd module			RK $\frac{1}{8}$ B6 10k Ω	Koa Denko	
D1	G9001HD	Diode		1S953		NEC	
Q1	A9222HQ	TSTR		2SB504-K		NEC	
U1	A9125LB	IC		SN74LS90N		TEXAS INST.	
U2	A9124LB	IC		SN74LS73N		TEXAS INST.	
U3	A9126LB	IC		SN74LS90N		TEXAS INST.	
U4	A9054LB	IC		SN74151N		TEXAS INST.	equivalent to HD2549P

5.8 RANGING CARD Ass'y: AS B9253HE (continued)

Item	Part No.	Part Name & Description		Manufacturer	Remarks
U5	A9125LB	IC	SN74LS90N	TEXAS INST.	ROM
U6	A9092LM	IC	C1302. (2504)	YEW	
U7	A9121LB	IC	SN74LS04N	TEXAS INST.	
U8	A9120LB	IC	SN74LS00N	TEXAS INST.	
U9	A9120LB	IC	SN74LS00N	TEXAS INST.	
U10	A9014LB	IC	SN7400N	TEXAS INST.	equivalent to HD2523P for U6
U11	A9120LB	IC	SN74LS00N	TEXAS INST.	
U12	A9120LB	IC	SN74LS00N	TEXAS INST.	
U13	A9120LB	IC	SN74LS00N	TEXAS INST.	
U14	A9122LB	IC	SN74LS10N	TEXAS INST.	
U15	A9123LB	IC	SN74LS20N	TEXAS INST.	
U16	A9123LB	IC	SN74LS20N	TEXAS INST.	
U17	A9123LB	IC	SN74LS20N	TEXAS INST.	
U18	A9123LB	IC	SN74LS20N	TEXAS INST.	
U19	A9019LB	IC	SN7405N	TEXAS INST.	
	B9253HG	Printed Wiring Board		YEW	
	A9030YC	Test point	(2 pcs.)	YEW	
	A9099KP	IC socket	DICA-24A-T1	JAE	
	A9003YC	Lever	(2 pcs.) PG01-00	YEW	
	Y9706PS	Pin	(2 pcs.)	YEW	

5.9 A/D CONVERTER Ass'y: AS B9253HJ

(75-08)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R1	A9025RS	Res: fxd car comp	220Ω	±10%	¼W RC¼GF220ΩK	YEW	2502-C101
R2		Res: fxd ww	30kΩ	±0.1%			
R3	A9034RS	Res: fxd car comp	1.2kΩ	±10%	¼W RC¼GF1.2kΩK		
R4	A9170RM	Res: fxd met flm	18kΩ	±5%	¼W RE50YR18kΩJ	Susumu	
R5	A9170RM	Res: fxd met flm	18kΩ	±5%	¼W RE50YR18kΩJ	Susumu	
R6	A9034RS	Res: fxd car comp	1.2kΩ	±10%	¼W RC¼GF1.2kΩK	YEW	2502-C101
R7	A9038RS	Res: fxd car comp	2.7kΩ	±10%	¼W RC¼GF2.7kΩK		
R8	A9045RS	Res: fxd car comp	10kΩ	±10%	¼W RC¼GF10kΩK		
R9	A9057RS	Res: fxd car comp	100kΩ	±10%	¼W RC¼GF100kΩK		
R10		Res: fxd ww	39kΩ	±0.3%			
R11	A9168RM	Res: fxd met flm	15kΩ	±5%	¼W RE50YR15kΩJ	Susumu	Copal
R12	A9172RM	Res: fxd met flm	22kΩ	±5%	¼W RE50YR22kΩJ	Susumu	
R13	A9147RM	Res: fxd met flm	2kΩ	±5%	¼W RE50YR2kΩJ	Susumu	
R14	A9140RM	Res: fxd met flm	1kΩ	±5%	¼W RE50YR1kΩJ	Susumu	
R15	A9133RM	Res: fxd met flm	510Ω	±5%	¼W RE50YR510ΩJ	Susumu	
R16	A9126RM	Res: fxd met flm	270Ω	±5%	¼W RE50YR270ΩJ	Susumu	
R17	A9038RS	Res: fxd car comp	2.7kΩ	±10%	¼W RC¼GF2.7kΩK		
R18	A9038RS	Res: fxd car comp	2.7kΩ	±10%	¼W RC¼GF2.7kΩK		
F19	A9508RV	Res: var cer met	500Ω	±10%	½W RJ-20P-501	Copal	
R20	A9053RS	Res: fxd car comp	47kΩ	±10%	¼W RC¼GF47kΩK		

5.9 A/D CONVERTER Ass'y: AS B9253HJ (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R21	A9053RS	Res: fxd car comp	47k Ω	$\pm 10\%$	1/4W RC1/4GF47k Ω K	Susumu	2502-C101
R22	A9135RM	Res: fxd met flm	620 Ω	$\pm 5\%$	1/4W RE50YR620 Ω J		
R23		Res: fxd ww	30k Ω	$\pm 0.1\%$		YEW	
R24	A9506RV	Res: var cermet	100 Ω	$\pm 10\%$	1/2W RJ-20P 101	Copal	
R25		Res: fxd ww	30k Ω	$\pm 0.1\%$		YEW	2502-C101
R26	A9175RM	Res: fxd met flm	30k Ω	$\pm 5\%$	1/4W RE50YR30k Ω J	Susumu	
R27	A9029RS	Res: fxd car comp	470 Ω	$\pm 10\%$	1/4W RC1/4GF470 Ω K		
R28	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R29	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R30	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R31	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R32	A9049RS	Res: fxd car comp	22k Ω	$\pm 10\%$	1/4W RC1/4GF22k Ω K		
R33	A9041RS	Res: fxd car comp	4.7k Ω	$\pm 10\%$	1/4W RC1/4GF4.7k Ω K		
R34	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	1/4W RC1/4GF10k Ω K		
R35	A9033RS	Res: fxd car comp	1k Ω	$\pm 10\%$	1/4W RC1/4GF1k Ω K		
R36	A9049RS	Res: fxd car comp	22k Ω	$\pm 10\%$	1/4W RC1/4GF22k Ω K		
R37	A9037RS	Res: fxd car comp	2.2k Ω	$\pm 10\%$	1/4W RC1/4GF2.2k Ω K		
R38	A9042RS	Res: fxd car comp	5.6k Ω	$\pm 10\%$	1/4W RC1/4GF5.6k Ω K		
R39	A9042RS	Res: fxd car comp	5.6k Ω	$\pm 10\%$	1/4W RC1/4GF5.6k Ω K		
R40	A9042RS	Res: fxd car comp	5.6k Ω	$\pm 10\%$	1/4W RC1/4GF5.6k Ω K		
R41	A9039RS	Res: fxd car comp	3.3k Ω	$\pm 10\%$	1/4W RC1/4GF3.3k Ω K		
R42	A9039RS	Res: fxd car comp	3.3k Ω	$\pm 10\%$	1/4W RC1/4GF3.3k Ω K		
R43	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	1/4W RC1/4GF220 Ω K		
R44	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	1/4W RC1/4GF220 Ω K		
R45	A9047RS	Res: fxd car comp	15k Ω	$\pm 10\%$	1/4W RC1/4GF15k Ω K		
R46	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R47	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R48	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R49	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R50	A9038RS	Res: fxd car comp	2.7k Ω	$\pm 10\%$	1/4W RC1/4GF2.7k Ω K		
R51	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	1/4W RC1/4GF10k Ω K		
R52	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	1/4W RC1/4GF220 Ω K		
R53	A9018RL	Res: fxd module			RK 1/8B6 10k Ω	Koa Denko	
C1	A9041CA	Cap: fxd Al elect	47 μ F		25V ECE-A25V47L	Matsushita	
C2	A9041CA	Cap: fxd Al elect	47 μ F		25V ECE-A25V47L	Matsushita	
C3	A9019CA	Cap: fxd Al elect	100 μ F		16V ECE-A16V100L	Matsushita	
C4	G9127CT	Cap: fxd Ta elect	22 μ F	$\pm 20\%$	20V TAXB2002-226M	Matsuo	
C5	G9127CT	Cap: fxd Ta elect	22 μ F	$\pm 20\%$	20V TAXB2002-226M	Matsuo	
C6	A9184CY	Cap: fxd polye flm	4.7 μ F	$\pm 10\%$	200V FNX-H2003-475K	Matsuo	
C7	A9019CN	Cap: fxd mica	33pF	$\pm 10\%$	100V DM05C330K1	Nitsuko	
C8	A9003CC	Cap: fxd cer	0.01 μ F		50V BLD1H103ZA	NEC	
C9	A9019CN	Cap: fxd mica	33pF	$\pm 10\%$	100V DM05C330K1	Nitsuko	
C10	A9066CY	Cap: fxd polye flm	2,200pF	$\pm 10\%$	100V MFL-1003-222K	Matsuo	
C11	A9064CY	Cap: fxd polye flm	1,000pF	$\pm 10\%$	100V MFL-1003-102K	Matsuo	
C12	A9064CY	Cap: fxd polye flm	1,000pF	$\pm 10\%$	100V MFL-1003-102K	Matsuo	
C13	A9094CA	Cap: fxd Al elect	47 μ F		16V ECE-B16V47L	Matsushita	
C14	A9021CN	Cap: fxd mica	47pF	$\pm 10\%$	100V DM05C470K1	Nitsuko	
C15	A9032CN	Cap: fxd mica	330pF	$\pm 10\%$	100V DM05C331K1	Nitsuko	

5.9 A/D CONVERTER Ass'y: AS B9253HJ (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
C16	A9025CN	Cap: fxd mica	100pF	±10%	100V DM05C101K1	Nitsuko	
C17	G9022CY	Cap: fxd polye flm	0.01μF	±10%	100V MFL-1003-103K	Matsuo	
C18	G9142CT	Cap: fxd Ta elect	100μF	±20%	10V TAXB-1002-107M	Matsuo	
C19	G9022CY	Cap: fxd polye flm	0.01μF	±10%	100V MFL-1003-103K	Matsuo	
C20	G9022CY	Cap: fxd polye flm	0.01μF	±10%	100V MFL-1003-103K	Matsuo	
C21	G9126CT	Cap: fxd Ta elect	22μF	±20%	10V TAXB-1002-226M	Matsuo	
C22	A9064CY	Cap: fxd polye flm	1,000pF	±10%	100V MFL-1003-102K	Matsuo	
C23	A9064CY	Cap: fxd polye flm	1,000pF	±10%	100V MFL-1003-102K	Matsuo	
C24	A9025CN	Cap: fxd mica	100pF	±10%	100V DM05C101K1	Nitsuko	
C25	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
D1	G9004HR	Diode			10D4	IRC Japan	
D2	G9001HD	Diode			1S953	NEC	
D3	G9001HD	Diode			1S953	NEC	
D4	G9023HD	Diode: zener			RD9A	NEC	
D5	G9023HD	Diode: zener			RD9A	NEC	
D6	G9023HD	Diode: zener			RD9A	NEC	
D7	G9029HD	Diode: zener			RD11A-M	NEC	
D8	G9029HD	Diode: zener			RD11A-M	NEC	
D9	G9001HD	Diode			1S953	NEC	
D10	A9143HD	Diode: zener			1S2192	NEC	
Q1	G9140HQ	TSTR			2SC943	NEC	
Q2	G9141HQ	TSTR			2SA603	NEC	
Q3	G9140HQ	TSTR			2SC943	NEC	
Q4	G9141HQ	TSTR			2SA603	NEC	
Q5	G9140HQ	TSTR			2SC943	NEC	
Q6	A9150HQ	TSTR			2SC1216	NEC	
Q7	A9150HQ	TSTR			2SC1216	NEC	
Q8	G9141HQ	TSTR			2SA603	NEC	
U1	G9034LA	IC			μPC157A (1)	NEC	
U2	G9034LA	IC			μPC157A (1)	NEC	
U3	G9034LA	IC			μPC157A (1)	NEC	
U4	A9039LB	IC			HD2515P	Hitachi	equivalent to SN7473N
U5	A9139LB	IC			HD2510P	Hitachi	equivalent to SN7474N
U6	A9045LB	IC			HD2521P	Hitachi	equivalent to SN7492N
U7	A9008LM	IC			CD4020AE	RCA	
U8	A9039LM	IC			HD2515P	Hitachi	equivalent to SN7473N
U9	A9010LM	IC			μPD851D	NEC	
U10	A9127LB	IC			LM555CN	NSC	
U11	A9049LB	IC			HD2543P	NEC	equivalent to SN7412N
U12	A9006LM	IC			CD4012AE	RCA	
U13	A9009LM	IC			CD4050AE	RCA	
U14	A9014LB	IC			HD2503P	Hitachi	equivalent to SN7400N
U15	A9014LB	IC			HD2503P	Hitachi	equivalent to SN7400N
U16	A9016LB	IC			HD2511P	Hitachi	equivalent to SN7402N
U17	A9003LB	IC			DM74L04N	NSC	
RL1	A9025MR	Relay			NR SD-12V	Matsushita	

5.9 A/D CONVERTER Ass'y: AS B9253HJ (continued)

Item	Part No.	Part Name & Description			Manufacturer	Remarks
X1	A9008EX	Quartz resonator		HC-6U	Kinsekisha	f=2.88MHz
	A9015EX	Quartz resonator socket		HC-6U/S	Yamaichi	
	A9016EX	Quartz resonator holder Type B		HC-6U	Yamaichi	
	A9001YC	Quartz resonator holding angle		PA-01	YEW	
	B9253HL	Printed Wiring Board			YEW	
	A9030YC	Test point	(11 pcs.)		YEW	
	A9101KP	IC Socket		DICA-28A-T1	JAE	for U9
	A9051KP	Feedthru	(2 pcs.)	FT-E-15	Fuso Shoji	
	A9003YC	Lever	(2 pcs.)	PG01-00	YEW	
	Y9706PS	Pin	(2 pcs.)		YEW	
	Y9304LB	Screw	(2 pcs.)	φ3,φ4, p0.5, LB	YEW	

5.10 DUAL RMS CONVERTER Ass'y: AS B9253HN

(175-08)

Item	Part No.	Part Name & Description			Manufacturer	Remarks
R1	A9184RM	Res: fxd met flm	68kΩ	±5% ¼W	RE50YR68kΩJ	Susumu
R2	A9161RM	Res: fxd met flm	7.5kΩ	±5% ¼W	RE50YR7.5kΩJ	Susumu
R3	A9184RM	Res: fxd met flm	68kΩ	±5% ¼W	RE50YR68kΩJ	Susumu
R4	A9232RM	Res: fxd met flm	4.7MΩ	±5% ½W	RE70YR4.7MΩJ	Susumu
R5	A9232RM	Res: fxd met flm	4.7MΩ	±5% ½W	RE70YR4.7MΩJ	Susumu
R6	A9021RS	Res: fxd car comp	100Ω	±10% ¼W	RC¼GF100ΩK	
R7	A9863RN	Res: fxd met flm	40kΩ	±0.1% ¼W	RN60E40kΩB	Tokyo Ko-on
R8	A9457RN	Res: fxd met flm	10kΩ	±0.1% ¼W	RN60E10kΩB	Tokyo Ko-on
R9	A9383RV	Res: var cermet	5kΩ	±10% ½W	RJ-6X-502	Copal
R10	A9271RV	Res: var cermet	20kΩ	±10% ½W	RJ-6X-203	Copal
R21	A9184RM	Res: fxd met flm	68kΩ	±5% ¼W	RE50YR68kΩJ	Susumu
R22	A9161RM	Res: fxd met flm	7.5kΩ	±5% ¼W	RE50YR7.5kΩJ	Susumu
R23	A9184RM	Res: fxd met flm	68kΩ	±5% ¼W	RE50YR68kΩJ	Susumu
R24	A9232RM	Res: fxd met flm	4.7MΩ	±5% ½W	RE70YR4.7MΩJ	Susumu
R25	A9232RM	Res: fxd met flm	4.7MΩ	±5% ½W	RE70YR4.7MΩJ	Susumu
R26	A9021RS	Res: fxd car comp	100Ω	±10% ¼W	RC¼GF100ΩK	
R27	A9863RN	Res: fxd met flm	40kΩ	±0.1% ¼W	RN60E40kΩB	Tokyo Ko-on
R28	A9457RN	Res: fxd met flm	10kΩ	±0.1% ¼W	RN60E10kΩB	Tokyo Ko-on
R29	A9383RV	Res: var cermet	5kΩ	±10% ½W	RJ-6X-502	Copal
R30	A9271RV	Res: var cermet	20kΩ	±10% ½W	RJ-6X-203	Copal
R40	A9063RS	Res: fxd car comp	47kΩ	±10% ¼W	RC¼GF47kΩK	
R41	A9045RS	Res: fxd car comp	10kΩ	±10% ¼W	RC¼GF10kΩK	
R42	A9045RS	Res: fxd car comp	10kΩ	±10% ¼W	RC¼GF10kΩK	
C1	A9125CT	Cap: fxd Ta elect	4.7μF	±20% 35V	TAXB3502-475M	Matsuo
C2	A9177CY	Cap: fxd polye flm	0.33μF	±10% 200V	FNX-H2003-334K	Matsuo
C3	A9025CM	Cap: fxd mica	100pF	±10% 100V	DM05C101K1	Nitsuko
C4	A9025CM	Cap: fxd mica	100pF	±10% 100V	DM05C101K1	Nitsuko

5.10 DUAL RMS CONVERTER Ass'y: AS B9253HN (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
C5	A9181CY	Cap: fxd polye flm	1.5μF	±10%	200V FNX-H2003-155K	Matsuo	
C21	A9125CT	Cap: fxd Ta elect	4.7μF	±20%	35V TAXB3502-475M	Matsuo	
C22	A9177CY	Cap: fxd polye flm	0.33μF	±10%	200V FNX-H2003-334K	Matsuo	
C23	A9025CM	Cap: fxd mica	100pF	±10%	100V DM05C101K1	Nitsuko	
C24	A9025CM	Cap: fxd mica	100pF	±10%	100V DM05C101K1	Nitsuko	
C25	A9181CY	Cap: fxd polye flm	1.5μF	±10%	200V FNX-H2003-155K	Matsuo	
C40	A9038CA	Cap: fxd Al elect	10μF		25V SL25VBSN-10	Matsushita	
C41	A9038CA	Cap: fxd Al elect	10μF		25V SL25VBSN-10	Matsushita	
C42	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C43	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C44	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C45	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C46	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C47	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C48	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C49	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H-103ZA	NEC	
C50	A9014CA	Cap: fxd Al elect	10μF		16V SL16VBSN-10	Matsushita	
Q40	G9140HQ	TSTR			2SC943	NEC	
Q41	G9140HQ	TSTR			2SC943	NEC	
D1	G9027HD	Diode: zener			RD11A	NEC	
D2	G9027HD	Diode: zener			RD11A	NEC	
D3	G9023HD	Diode: zener			RD9A	NEC	
D4	G9023HD	Diode: zener			RD9A	NEC	
D21	G9027HD	Diode: zener			RD11A	NEC	
D22	G9027HD	Diode: zener			RD11A	NEC	
D23	G9023HD	Diode: zener			RD9A	NEC	
D24	G9023HD	Diode: zener			RD9A	NEC	
D41	G9001HD	Diode			1S953	NEC	
U1	A9009LH	IC			6005	YEW	
U2	G9034LA	IC			μPC157A (1)	NEC	
U21	A9009LH	IC			6005	YEW	
U22	G9034LA	IC			μPC157A (1)	NEC	
	B9253HQ	Printed Wiring Board				YEW	
	A9030YC	Test point	(5 pcs.)			YEW	
	A9003YC	Lever	(2 pcs.)		PG01-00	YEW	
	Y9706PS	Pin	(2 pcs.)			YEW	

5.11 MULTIPLIER Ass'y: AS B9253HS

(75-08)

Item	Part No.	Part Name & Description					Manufacturer	Remarks
R1	A9138RM	Res: fxd met flm	820Ω	±5%	¼W	RE50YR820ΩJ	Susumu	
R2	A9232RN	Res: fxd met flm	3kΩ	±0.1%	¼W	RN60E3kΩB	Tokyo Ko-on	
R3	G9019RN	Res: fxd met flm	10kΩ	±0.1%	¼W	RN60E10kΩB	Tokyo Ko-on	
R4	G9019RN	Res: fxd met flm	10kΩ	±0.1%	¼W	RN60E10kΩB	Tokyo Ko-on	
R5	G9019RN	Res: fxd met flm	10kΩ	±0.1%	¼W	RN60E10kΩB	Tokyo Ko-on	
R6	A9239RN	Res: fxd met flm	5kΩ	±0.1%	¼W	RN60E5kΩB	Tokyo Ko-on	
R7	A9239RN	Res: fxd met flm	5kΩ	±0.1%	¼W	RN60E5kΩB	Tokyo Ko-on	
R8		not used						
R9	G9019RN	Res: fxd met flm	10kΩ	±0.1%	¼W	RN60E10kΩB	Tokyo Ko-on	
R10	G9019RN	Res: fxd met flm	10kΩ	±0.1%	¼W	RN60E10kΩB	Tokyo Ko-on	
R11		not used						
R12	A9232RM	Res: fxd met flm	4.7MΩ	±5%	¼W	RE70YR4.7MΩJ	Susumu	
R13		not used						
R14		not used						
R15		not used						
R16		not used						
R17	A9037RS	Res: fxd car comp	2.2kΩ	±10%	¼W	RC¼GF2.2kΩK		
R18	A9041RS	Res: fxd car comp	4.7kΩ	±10%	¼W	RC¼GF4.7kΩK		
R19	A9031RS	Res: fxd car comp	680Ω	±10%	¼W	RC¼GF680ΩK		
R20	A9035RS	Res: fxd car comp	1.5kΩ	±10%	¼W	RC¼GF1.5kΩK		
R21		not used						
R22		not used						
R23	A9128RM	Res: fxd met flm	330Ω	±5%	¼W	RE50YR330ΩJ	Susumu	
R24	A9128RM	Res: fxd met flm	330Ω	±5%	¼W	RE50YR330ΩJ	Susumu	
R25	A9152RM	Res: fxd met flm	3.3kΩ	±5%	¼W	RE50YR3.3kΩJ	Susumu	
R26	A9152RM	Res: fxd met flm	3.3kΩ	±5%	¼W	RE50YR3.3kΩJ	Susumu	
R27		not used						
R28		not used						
R29	A9052RV	Res: var ww	10kΩ	±5%	¼W	TF12X103	Japan Servo	
R30		not used						
R31	G9068RN	Res: fxd met flm	20kΩ	±0.1%	¼W	RN60E20kΩB	Tokyo Ko-on	
R32	A9863RN	Res: fxd met flm	40kΩ	±0.1%	¼W	RN60E40kΩB	Tokyo Ko-on	
R33	G9068RN	Res: fxd met flm	20kΩ	±0.1%	¼W	RN60E20kΩB	Tokyo Ko-on	
R34	G9068RN	Res: fxd met flm	20kΩ	±0.1%	¼W	RN60E20kΩB	Tokyo Ko-on	
R35	G9068RN	Res: fxd met flm	20kΩ	±0.1%	¼W	RN60E20kΩB	Tokyo Ko-on	
R36	A9230RM	Res: fxd met flm	1MΩ	±5%	½W	RE70YR1MΩJ	Susumu	
R37	A9188RM	Res: fxd met flm	100kΩ	±5%	¼W	RE50YR100kΩJ	Susumu	
R38	A9232RM	Res: fxd met flm	4.7MΩ	±5%	½W	RE70YR4.7MΩJ	Susumu	
R39		not used						
R40	G9068RN	Res: fxd met flm	20kΩ	±0.1%	¼W	RN60E20kΩB	Tokyo Ko-on	
R41	G9023RN	Res: fxd met flm	100kΩ	±0.1%	¼W	RN60E100kΩB	Tokyo Ko-on	
R42		not used						
R43	A9046RS	Res: fxd car comp	12kΩ	±10%	¼W	RC¼GF12kΩK		
R44		not used						
R45	A9232RM	Res: fxd met flm	4.7MΩ	±5%	½W	RE70YR4.7MΩJ	Susumu	
R46	A9310RN	Res: fxd met flm	25kΩ	±0.1%	¼W	RN60E25kΩB	Tokyo Ko-on	
R47	A9054RP	Res: fxd met flm	125kΩ	±0.1%	¼W	RN60E125kΩB	Tokyo Ko-on	
R48	A9052RS	Res: fxd car comp	39kΩ	±10%	¼W	RC¼GF39kΩK		
R49	A9021RS	Res: fxd car comp	100Ω	±10%	¼W	RC¼GF100ΩK		
R50	A9271RV	Res: var cermet	20kΩ	±10%	½W	RJ-6X-203	Copal	

5.11 MULTIPLIER Ass'y: AS B9253HS (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R51	A9270RV	Res: var cermet	500 Ω	$\pm 10\%$	$\frac{1}{2}W$	RJ-6X 501	Copal
R52	A9049RS	Res: fxd car comp	22k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF22k Ω K	
R53	A9180RM	Res: fxd met flm	47k Ω	$\pm 5\%$	$\frac{1}{4}W$	RE50YR47k Ω J	Susumu
R54	A9180RM	Res: fxd met flm	47k Ω	$\pm 5\%$	$\frac{1}{4}W$	RE50YR47k Ω J	Susumu
R55		not used					
R56		not used					
R57		not used					
R58	A9052RV	Res: var ww	10k Ω	$\pm 5\%$	$\frac{1}{4}W$	TF12X103	Japan Servo
R59	A9348RV	Res: var cermet	10k Ω	$\pm 10\%$	$\frac{1}{2}W$	RJ-6X-103	Copal
R60		not used					
R61	A9034RS	Res: fxd car comp	1.2k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF1.2k Ω K	
R62	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF10k Ω K	
R63	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF10k Ω K	
R64	A9033RS	Res: fxd car comp	1k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF1k Ω K	
R65	A9033RS	Res: fxd car comp	1k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF1k Ω K	
R66		not used					
R67		not used					
R68		not used					
R69		not used					
R70	A9053RS	Res: fxd car comp	47k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF47k Ω K	
R71	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF10k Ω K	
R72	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF10k Ω K	
R73	A9001RS	Res: fxd car comp	2.2 Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF2.2 Ω K	
R74	A9001RS	Res: fxd car comp	2.2 Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF2.2 Ω K	
R75	A9001RS	Res: fxd car comp	2.2 Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF2.2 Ω K	
R76	A9001RS	Res: fxd car comp	2.2 Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF2.2 Ω K	
R77	A9001RS	Res: fxd car comp	2.2 Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF2.2 Ω K	
R78	A9001RS	Res: fxd car comp	2.2 Ω	$\pm 10\%$	$\frac{1}{4}W$	RC $\frac{1}{4}$ GF2.2 Ω K	
C1	A9014CA	Cap: fxd Al elect	10 μ F		16V	SL16VBSN-10	Matsushita
C2	G9121CT	Cap: fxd Ta elect	10 μ F	$\pm 20\%$	20V	TAXB2002-106M	Matsuo
C3	G9027CN	Cap: fxd mica	150pF	$\pm 10\%$	100V	DM05C151K1	Nitsuko
C4	A9013CN	Cap: fxd mica	10pF	$\pm 10\%$	100V	DM05C100K1	Nitsuko
C5	A9068CN	Cap: fxd mica	470pF	$\pm 10\%$	100V	DM15C471K1	Nitsuko
C6	A9023CN	Cap: fxd mica	68pF	$\pm 10\%$	100V	DM05C680K1	Nitsuko
C7	A9027CN	Cap: fxd mica	150pF	$\pm 10\%$	100V	DM05C151K1	Nitsuko
C8		not used					
C9	A9072CN	Cap: fxd mica	1000pF	$\pm 10\%$	100V	DM15C102K1	Nitsuko
C10	A9003CC	Cap: fxd cer	0.01 μ F		50V	BLD1H103ZA	NEC
C19	A9024CV	Cap: var cer	5.5 ~ 70pF			ECV1ZW70P40	Matsushita
C31	A9027CN	Cap: fxd mica	150pF	$\pm 10\%$	100V	DM05C151K1	Nitsuko
C32	A9013CN	Cap: fxd mica	10pF	$\pm 10\%$	100V	DM05C100K1	Nitsuko
C33	A9027CN	Cap: fxd mica	150pF	$\pm 10\%$	100V	DM05C151K1	Nitsuko
C34	A9179CY	Cap: fxd polye flm	0.68 μ F	$\pm 10\%$	200V	FNX-H2003-684K	Matsuo
C35	A9175CY	Cap: fxd polye flm	0.15 μ F	$\pm 10\%$	200V	FNX-H2003-154K	Matsuo
C36	A9025CN	Cap: fxd mica	100pF	$\pm 10\%$	100V	DM05C101K1	Nitsuko
C37	A9019CN	Cap: fxd mica	33pF	$\pm 10\%$	100V	DM05C330K1	Nitsuko
C38	A9181CY	Cap: fxd polye flm	1.5 μ F	$\pm 10\%$	200V	FNX H2003-155K	Matsuo
C61	A9179CY	Cap: fxd polye flm	0.68 μ F	$\pm 10\%$	200V	FNX H2003-684K	Matsuo

5.11 MULTIPLIER Ass'y: AS B9253HS (continued)

Item	Part No.	Part Name & Description				Manufacturer	Remarks
C62	A9019CN	Cap: fxd mica	33pF	±10%	100V DM05C330K1	Nitsuko	
C63	A9019CN	Cap: fxd mica	33pF	±10%	100V DM05C330K1	Nitsuko	
C64	A9065CY	Cap: fxd polye film	1,500pF	±10%	100V MFL-1003-152K	Matsuo	
C65	A9065CY	Cap: fxd polye film	1,500pF	±10%	100V MFL-1003-152K	Matsuo	
C71	A9038CA	Cap: fxd Al elect	10μF		25V SL25VBSN-10	Matsushita	
C72	A9038CA	Cap: fxd Al elect	10μF		25V SL25VBSN-10	Matsushita	
C73	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C74	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C75	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C76	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C77	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C78	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C79	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C80	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C81	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C82	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C83	A9014CA	Cap: fxd Al elect	10μF		16V SL16VBSN-10	Matsushita	
C84	A9014CA	Cap: fxd Al elect	10μF		16V SL16VBSN-10	Matsushita	
C85	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C86	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C87	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C88	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
C89	A9003CC	Cap: fxd cer	0.01μF		50V BLD1H103ZA	NEC	
Q1	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q2	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q3	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q4	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q5	A9150HQ	TSTR:			2SC1216	NEC	
Q31	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q32	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q33	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q34	A9176HQ	TSTR: FET			2SK23A	SONY	AJ718K102
Q71	G9140HQ	TSTR			2SC943	NEC	
Q72	G9140HQ	TSTR			2SC943	NEC	
D1	S9241HR	Diode: zener			1S2192	NEC	
D2	G9001HD	Diode			1S953	NEC	
D3	G9001HD	Diode			1S953	NEC	
D4	G9024HD	Diode: zener			RD9A (L)	NEC	
D5	G9024HD	Diode: zener			RD9A (L)	NEC	
D31	G9001HD	Diode			1S953	NEC	
D32	G9001HD	Diode			1S953	NEC	
D33	G9001HD	Diode			1S953	NEC	
D34	G9001HD	Diode			1S953	NEC	
D35	G9024HD	Diode: zener			RD9A (L)	NEC	
D36	G9024HD	Diode: zener			RD9A (L)	NEC	
D61	G9001HD	Diode			1S953	NEC	

5.11 MULTIPLIER Ass'y: AS B9253HS (continued)

Item	Part No.	Part Name & Description			Manufacturer	Remarks
D62	G9001HD	Diode		1S953	NEC	
D71	G9001HD	Diode		1S953	NEC	
U1	G9034LA	IC		μPC157A (1)	NEC	
U2	G9034LA	IC		μPC157A (1)	NEC	
U3	A9028LB	IC		SN7420N	TEXAS INST.	
U4	A9064LB	IC		SN75110N	TEXAS INST.	
U31	G9034LA	IC		μPC157A (1)	NEC	
U32	G9034LA	IC		μPC157A (1)	NEC	
U33	G9034LA	IC		μPC157A (1)	NEC	
U61	A9014LB	IC		SN7400N	TEXAS INST.	
	B9253HU	Printed Wiring Board			YEW	
	A9036KH	IC socket	(5 pcs.)	IC-03-3A	Yamaichi	
	A9027KH	IC socket	(3 pcs.)	821-20011-144	BARNES	
	A9030YC	Test point	(11 pcs.)		YEW	
	A9003YC	Lever	(2 pcs.)	PG01-00	YEW	
	Y9706PS	Pin	(2 pcs.)		YEW	

5.12 BCD Ass'y: AS B9253XX (Option)

(75-08)

Item	Part No.	Part Name & Description			Manufacturer	Remarks
	B9253XA	CONNECTOR Ass'y			YEW	see Fig. 5-10
	B9253YA	BCD OUTPUT CARD Ass'y			YEW	

5.12.1 CONNECTOR Ass'y: AS B9253XA

Item	Part No.	Part Name & Description			Manufacturer	Remarks
	B9253XC	Plate			YEW	
J1	A9031KC	Conn. jack		57-40500	AMPHENOL	
J2	A9031KC	Conn. jack		57-40500	AMPHENOL	
J3		not used				
J4	A9108KP	Conn. jack		PS-20SD-D4C2	JAE	
J5	A9109KP	Conn. jack		PS-56SD-D4C2	JAE	
	A9120KP	Socket contact	(74 pcs.)	PS-SD-C2N-1	JAE	
	G9006VN	Flat cable				
	Y9208KB	Screw	(4 pcs.)	φ2.3, φ8, p0.4, KB	YEW	

5.12.2 BCD OUTPUT CARD Assy: AS B9253YA

Item	Part No.	Part Name & Description				Manufacturer	Remarks
R1	A9038RS	Res: fxd car comp	2.7k Ω	$\pm 10\%$	1/4W RC1/4GF2.7k Ω K		
R2	A9053RS	Res: fxd car comp	47k Ω	$\pm 10\%$	1/4W RC1/4GF47k Ω K		
R3	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	1/4W RC1/4GF10k Ω K		
R4	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R5	A9040RS	Res: fxd car comp	3.9k Ω	$\pm 10\%$	1/4W RC1/4GF3.9k Ω K		
R6	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	1/4W RC1/4GF10k Ω K		
R7	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	1/4W RC1/4GF10k Ω K		
R8	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	1/4W RC1/4GF220 Ω K		
R9	A9025RS	Res: fxd car comp	220 Ω	$\pm 10\%$	1/4W RC1/4GF220 Ω K		
R10	A9045RS	Res: fxd car comp	10k Ω	$\pm 10\%$	1/4W RC1/4GF10k Ω K		
R11	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R12	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R13	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R14	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R15	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R16	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R17	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R18	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
R19	A9018RL	Res: fxd module			RK1/8B6 10k Ω	Koa Denko	
C1	A9019CA	Cap: fxd Al elect	100 μ F		16V ECE-A16V100L	Matsushita	
C2	A9072CY	Cap: fxd polye flm	0.047 μ F	$\pm 10\%$	100V MFL-1003-473K	Matsuo	
C3	A9064CY	Cap: fxd polye flm	1000pF	$\pm 10\%$	100V MFL-1003-102K	Matsuo	
C4	A9038CA	Cap: fxd Al elect	10 μ F		25V ECE-A25V10L	Matsushita	
C5	A9038CA	Cap: fxd Al elect	10 μ F		25V ECE-A25V10L	Matsushita	
Q1	G9140HQ	TSTR			2SC943	NEC	
Q2	G9140HQ	TSTR			2SC943	NEC	
U1	A9007LM	IC			CD4015AE	RCA	
U2	A9007LM	IC			CD4015AE	RCA	
U3	A9104LB	IC			DM74L74N	NSC	
U4	A9105LB	IC			DM74L93N	NSC	
U5	A9009LM	IC			CD4050AE	RCA	
U6	A9009LM	IC			CD4050AE	RCA	
U7	A9009LM	IC			CD4050AE	RCA	
U8	A9019LB	IC			HD2523P	Hitachi	equivalent to SN7405N
U9	A9019LB	IC			HD2523P	Hitachi	equivalent to SN7405N
U10	A9019LB	IC			HD2523P	Hitachi	equivalent to SN7405N
U11	A9019LB	IC			HD2523P	Hitachi	equivalent to SN7405N
U12	A9018LB	IC			HD2522P	Hitachi	equivalent to SN7404
U13	A9003LB	IC			DM74L04N	NSC	
U14	A9014LB	IC			HD2503P	Hitachi	equivalent to SN7400N
U15	A9024LB	IC			HD2507P	Hitachi	equivalent to SN7410N
U16	A9016LB	IC			HD2511P	Hitachi	equivalent to SN7402N
U17	A9021LB	IC			SN7407N	TEXAS INST	
U18	A9023LB	IC			HD2551P	Hitachi	equivalent to SN7409N
U19	A9023LB	IC			HD2551P	Hitachi	equivalent to SN7409N

5.12.2 BCD OUTPUT CARD Ass'y: AS B9253YA (continued)

Item	Part No.	Part Name & Description		Manufacturer	Remarks
U20	A9023LB	IC	HD2551P	Hitachi	equivalent to SN7409N equivalent to SN7409N
U21	A9023LB	IC	HD2551P	Hitachi	
P1	A9106KP	Conn: plug	PS-56PA-D4LT1-A1	JAE	
	B9253YC	Printed Wiring Board		YEW	
	A9003YC	Lever	(2 pcs.) PG01-00	YEW	
	Y9706PS	Pin	(2 pcs.)	YEW	

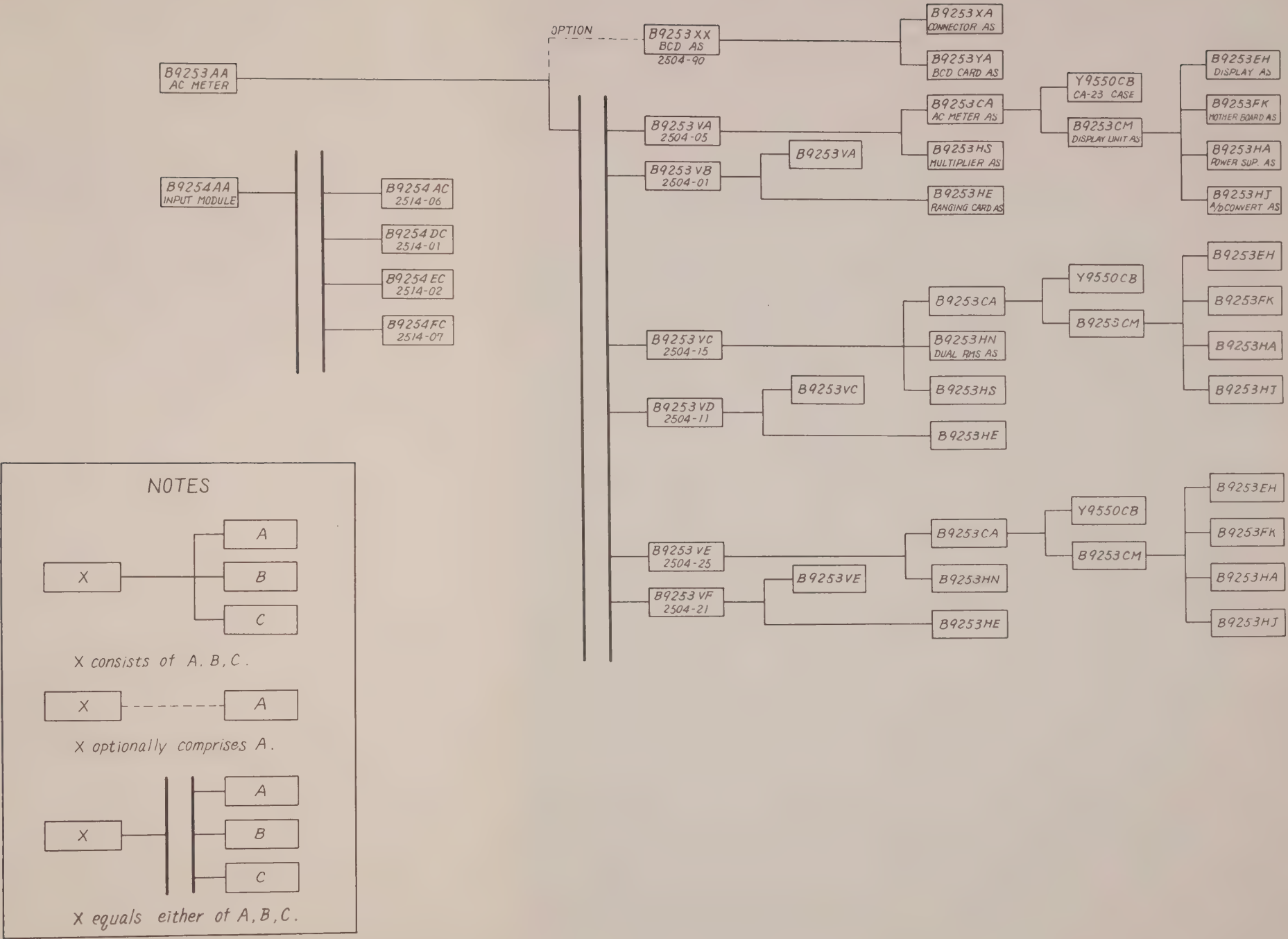
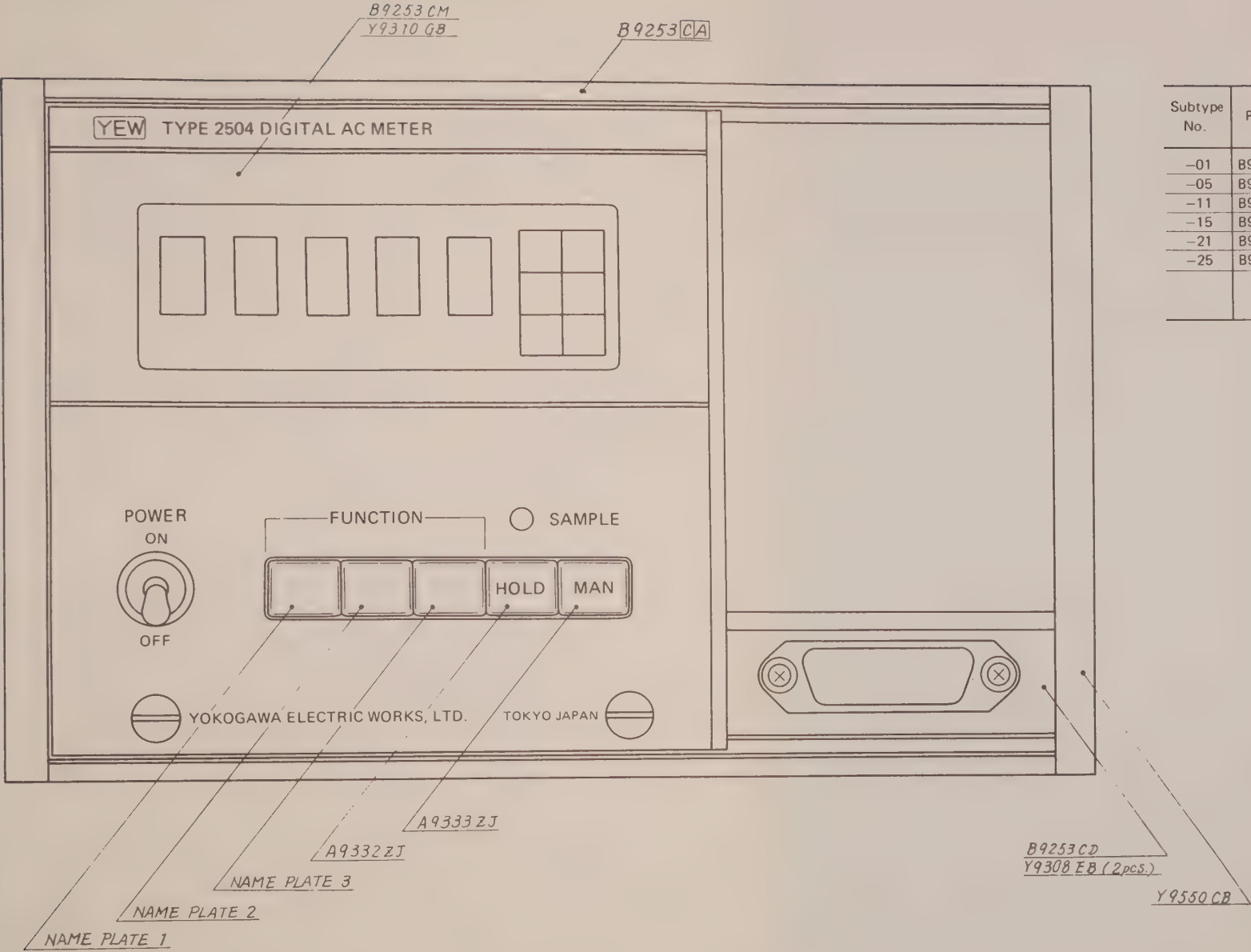
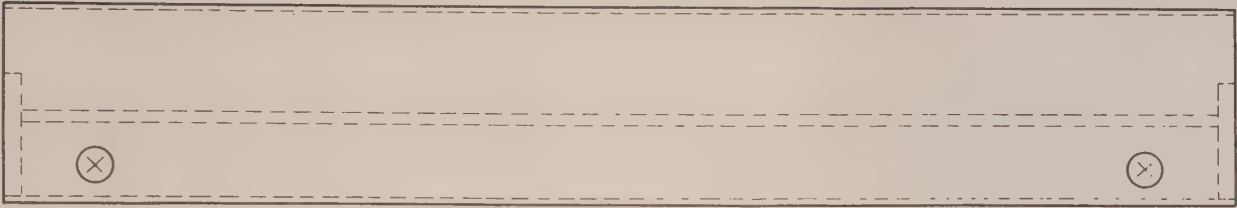


Fig. 5-1
DIGITAL AC METER
Type 2504 ASSEMBLY DIAGRAM



Subtype No.	Part No.	NAME PLATE					
		1	Mark	2	Mark	3	Mark
-01	B9253VB	A9328ZJ		A9328ZJ		A9329ZJ	W
-05	B9253VA						
-11	B9253VD	A9330ZJ	Vrms	A9331ZJ	Arms	A9329ZJ	W
-15	B9253VC						
-21	B9253VF	A9330ZJ	Vrms	A9331ZJ	Arms	A9328ZJ	
-25	B9253VE						

Fig. 5-2
AC METER Ass'y:
AS B9253□□



A9022 KC (2 pcs.)
Y9208 KB (4 pcs.)
Y9230 SP (4 pcs.)
Y9230 WB (4 pcs.)

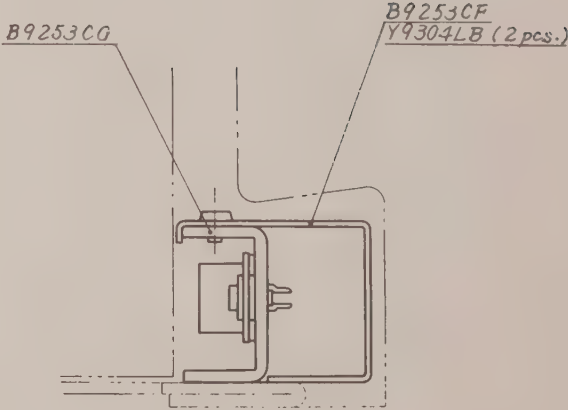
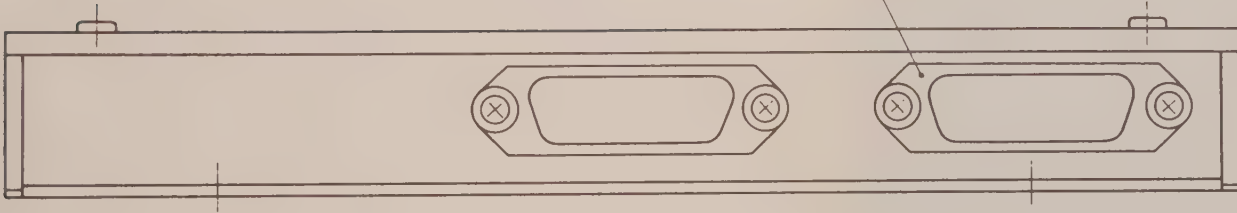


Fig. 5-3
CONNECTOR Ass'y:
AS B9253CD

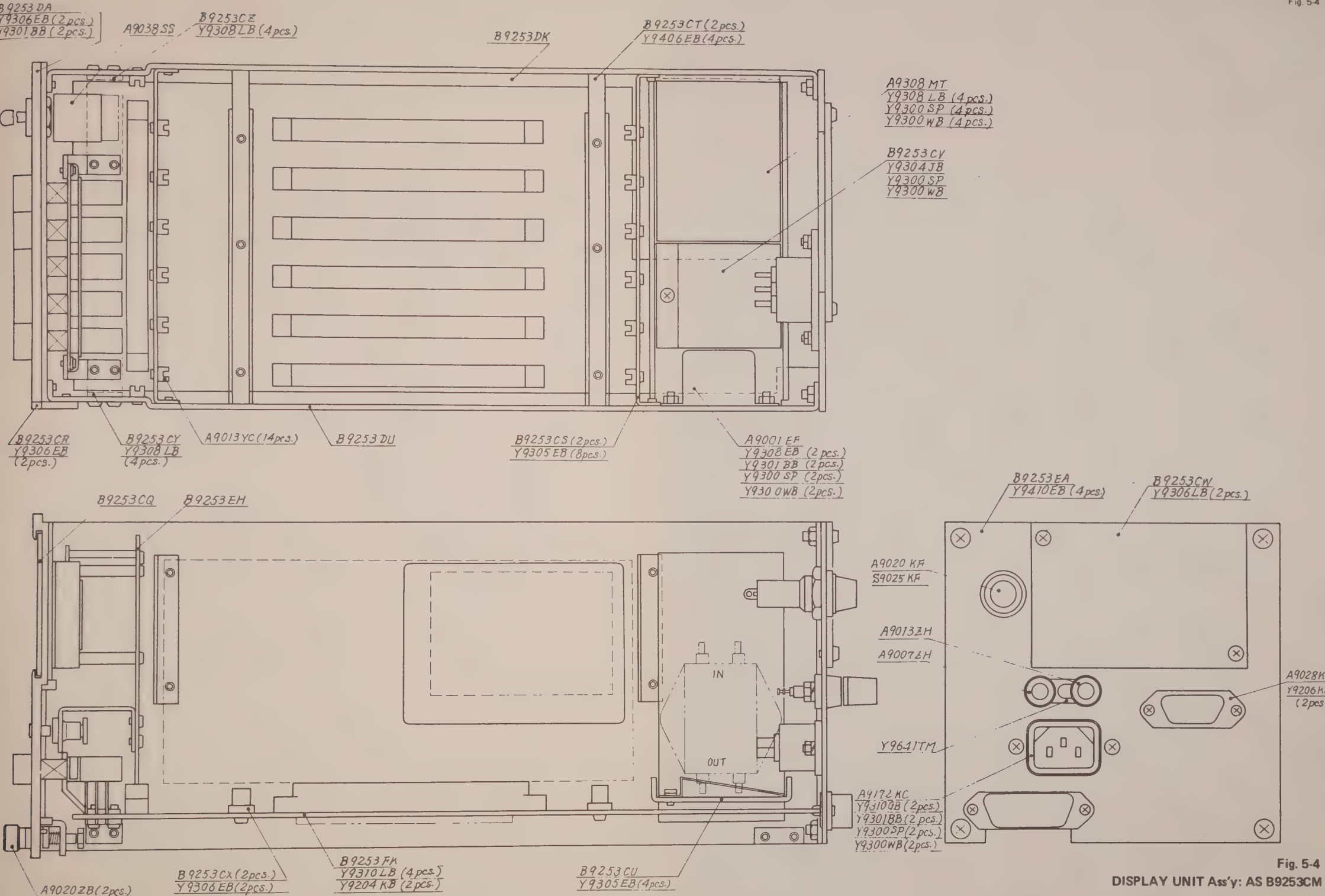


Fig. 5-4
DISPLAY UNIT Ass'y: AS B9253CM

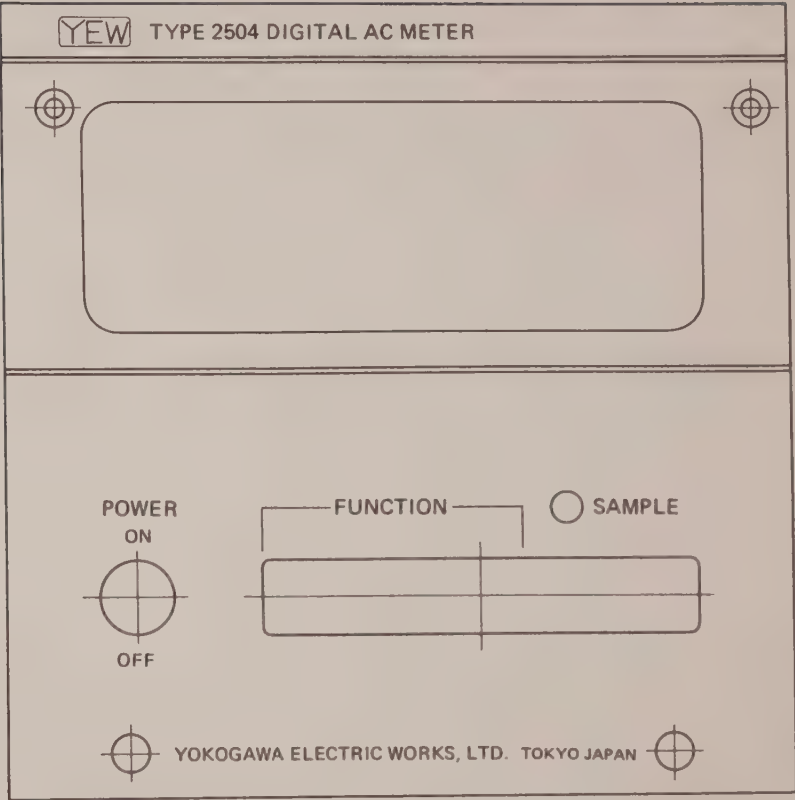
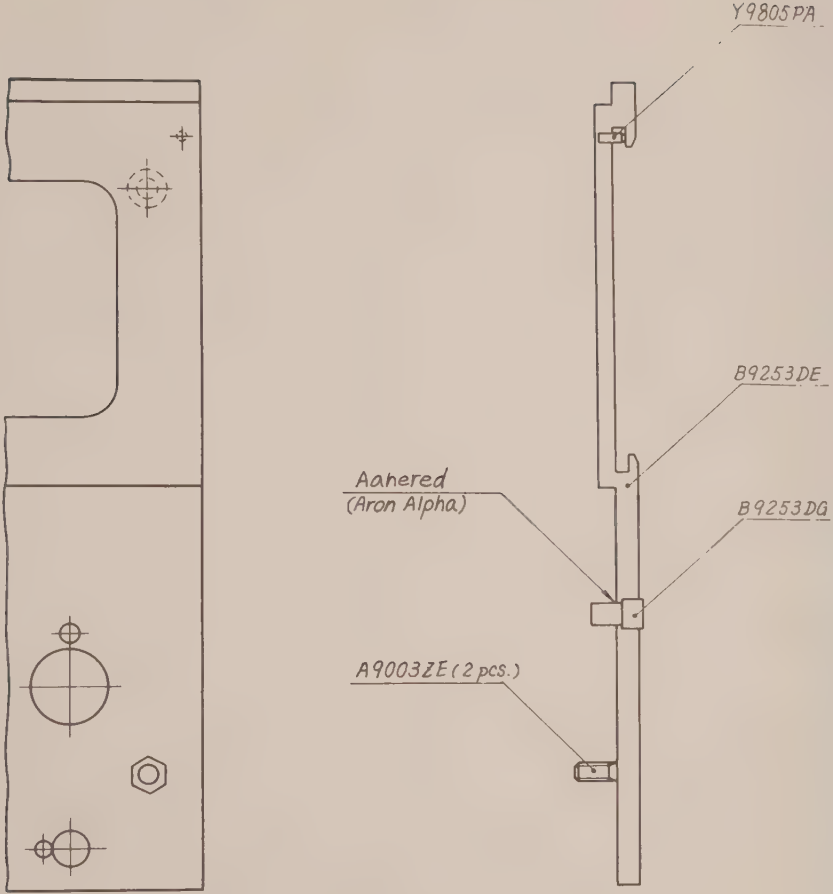
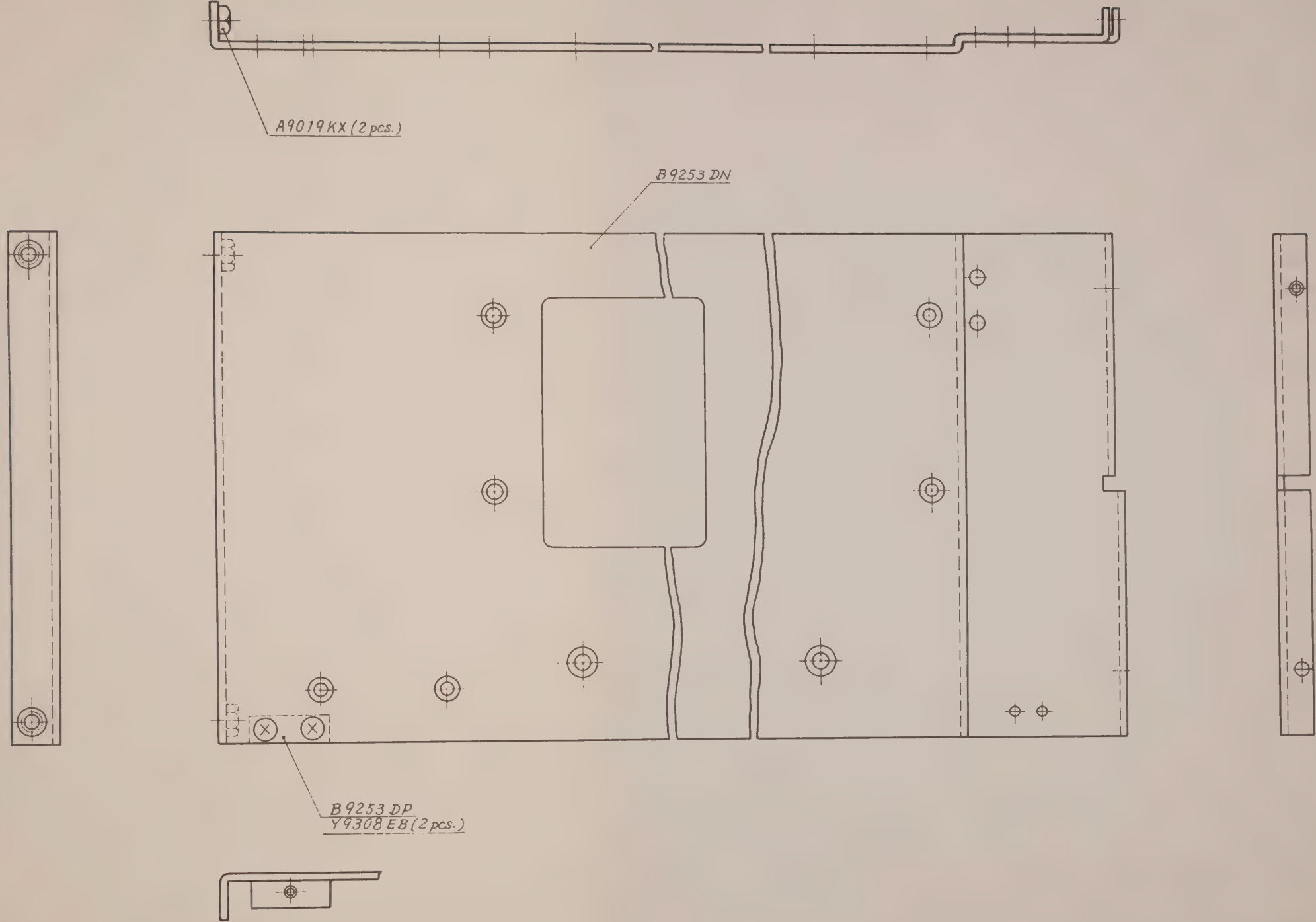


Fig. 5-5 PANEL Ass'y: AS B9253DA



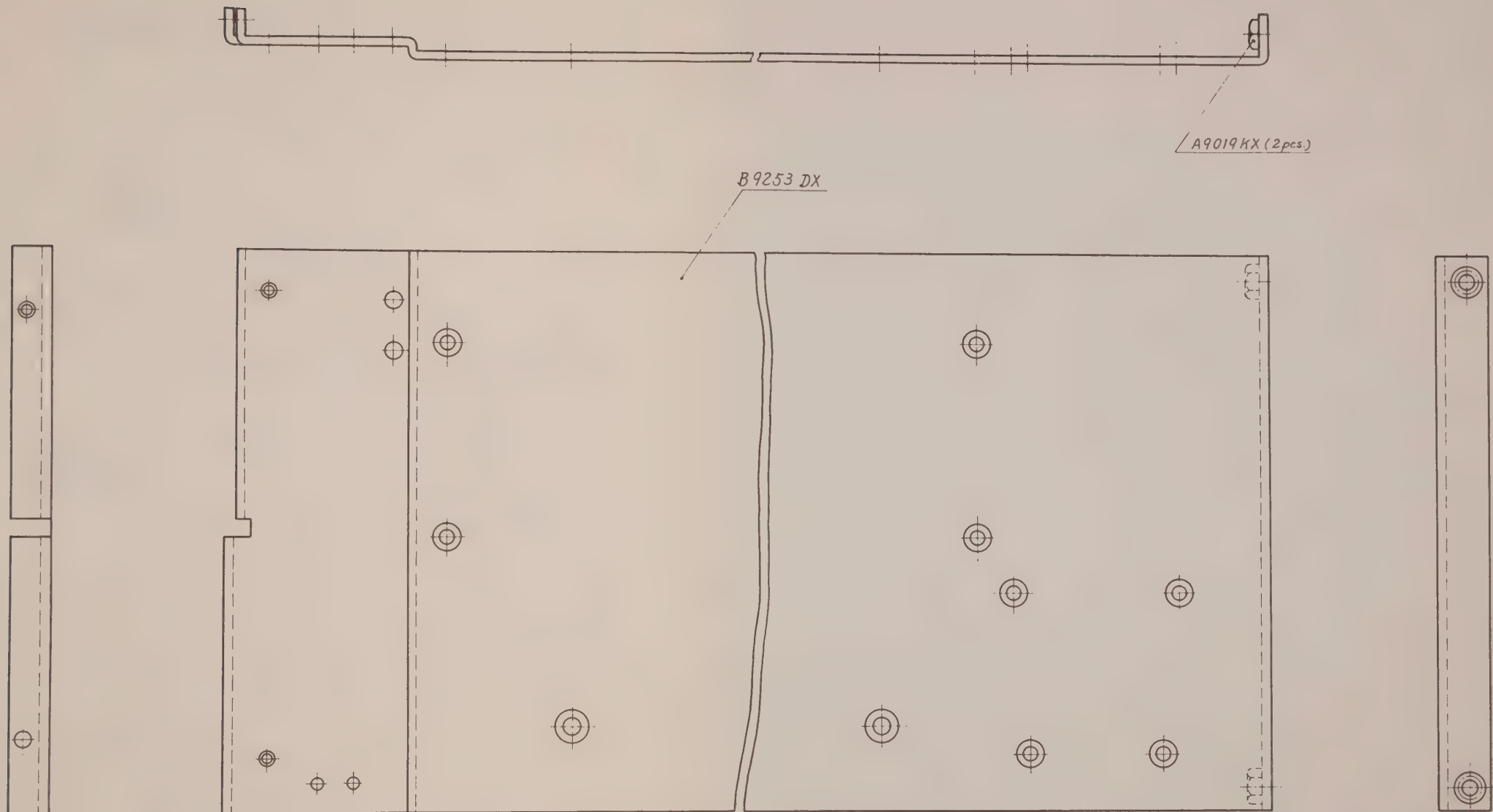


Fig. 5-7 BRACKET Ass'y: AS B9253DU

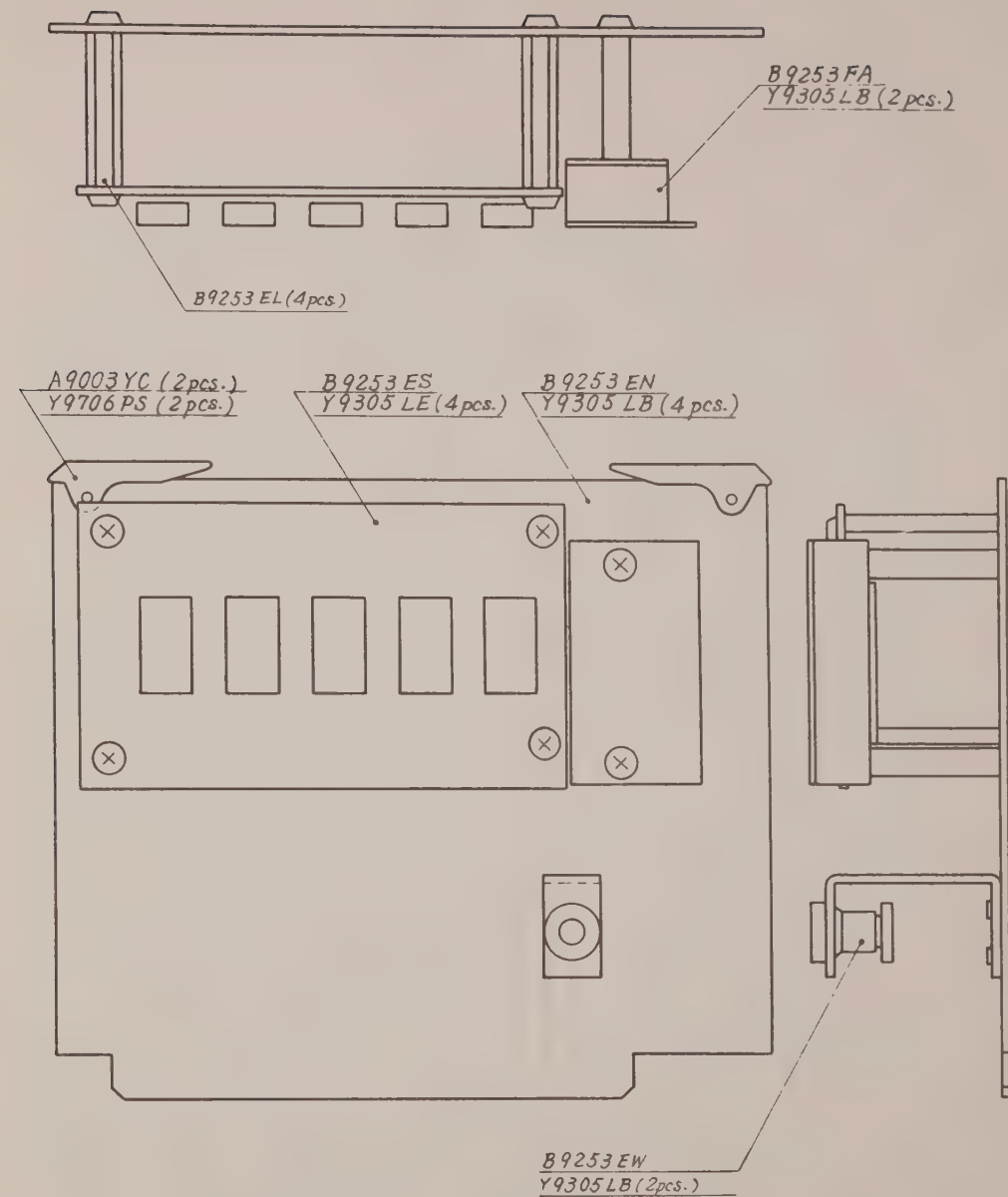
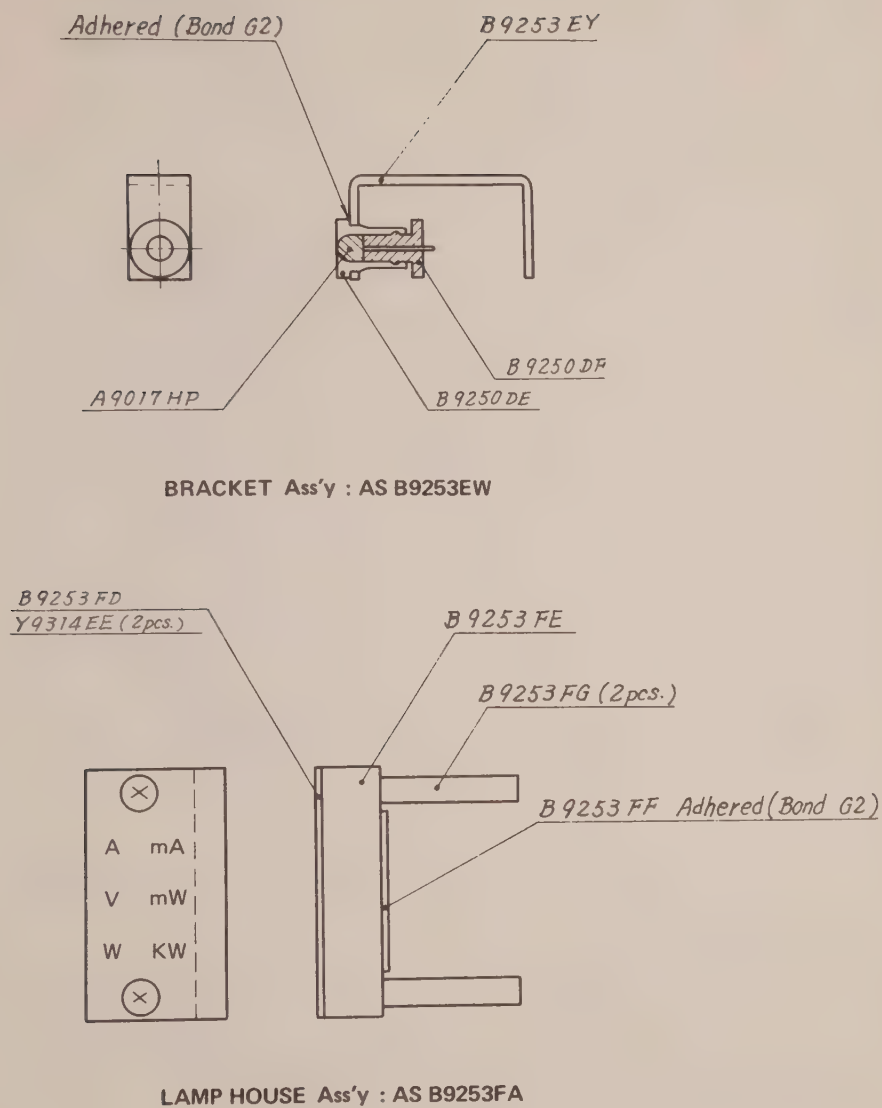


Fig. 5-8 DISPLAY Ass'y: AS B9253EH

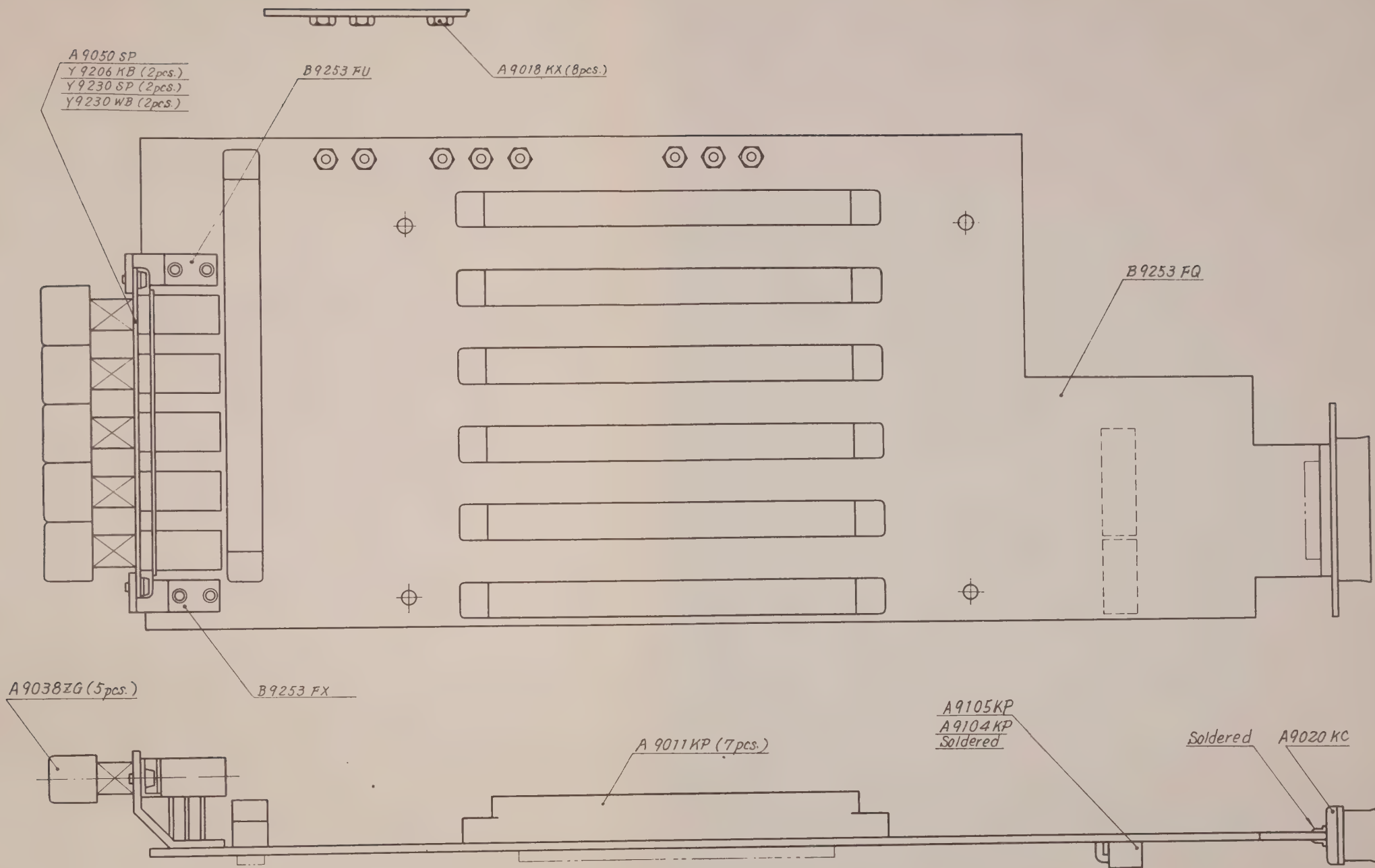


Fig. 5-9
MOTHER BOARD Ass'y:
AS B9253FK

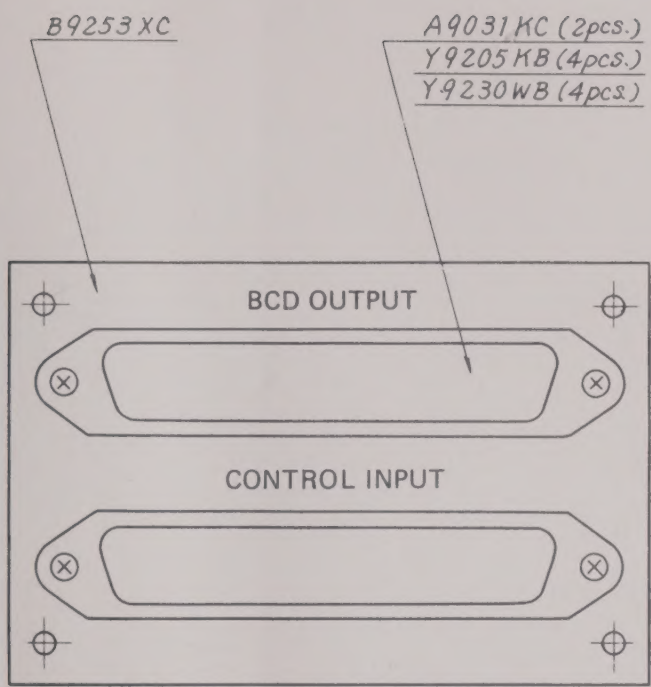


Fig. 5-10 CONNECTOR Ass'y: AS B9253 XA (Option)

SERVICING FACILITIES

YOKOGAWA CORPORATION OF AMERICA

5 Westchester Plaza, Elmsford, New York 10523, U. S. A.

Phone: 914-592-6767

Telex: 710-567-1256, YCA EMFD

Cable Address: YOKOGAWANY ELMSFORD

YOKOGAWA ELECTRIC (EUROPE) B. V.

Nederhoven 17-19-21, Buitenveldert, Amsterdam, THE NETHERLANDS

Phone: 020-423194

Telex: 44-14094 YEW NL

YOKOGAWA ELÉTRICA DO BRASIL IND. E COM. LTDA.

- Rua Florêncio de Abreu, 643, 3ª-Andar, S/305, São Paulo, S. P., BRASIL

Phone: 227-4740

Telex: 1121538 DCBL BR

- Rua Miguel Couto, 134, Sala 1003, Rio De Janeiro, R. J., BRASIL

Phone: 243-3034

YOKOGAWA ELECTRIC SINGAPORE, PTE., LTD.

5, Bedok Plain, Singapore 16, SINGAPORE

Phone: 419933

Telex: RS 23430 YESPORE

YOKOGAWA CORPORATION OF ASIA PTE. LTD.

5, Bedok Plain, Singapore 16, SINGAPORE

Phone: 419933

Telex: RS 23430 YESPORE

YOKOGAWA M. E. REPRESENTATIVE OFFICE

House No. 87, Abbas-Abad, Mahnaz Ave., 9th Street, Teheran, IRAN

Phone: 946521

YOKOGAWA ENGINEERING CENTER (LIAISON OFFICE)

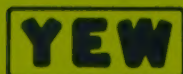
- Room 505, Rajun Bldg., 117, Da-Dong, Jong-Ku, Seoul, KOREA

Phone: 777-1776

Cable Address: YOKOGAWA SEOUL

- 3rd Floor, 719-18 Yun San-Dong, Dong Rae-Ku, Busan, KOREA

Phone: 52-1182



YOKOGAWA ELECTRIC WORKS, LTD.

9-32, Nakacho, 2-chome, Musashino-shi, TOKYO 180, JAPAN

Phone: Tokyo 0422-54-1111

Telex: 02822-327 YEW MT J

Cable Address: TLX 2822-327 YOKOGAWA TOKYO

MP MASTER



MA25314